Marco Chichì

Licenciado em Ciências de Engenharia Civil

Sustainable Urban Planning:
parameters to the operational process

Dissertação para obtenção do Grau de Mestre em
Engenheria Civil – Perfil construção

Orientador: Miguel Pires Amado, Professor Auxiliar com Agregação da Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa

Júri:
Presidente: Prof. Doutor Nuno Manuel da Costa Guerra
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Vogal: Prof. Doutor Miguel José das Neves Pires Amado

FACULDADE DE CIÊNCIAS E TECNOLOGIA
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ABSTRACT

In modern society, energy consumption and respect for the environment have become essential aspects of urban planning. The rising demand for alternative sources of energy, coupled with the decline in the construction sector and material usage, gives the idea that the thinking on modern cities, where attention is given to reduced energy consumption, savings, waste recycling and respect for the surrounding environment, is being put into practice.

If we examine development of the city over recent centuries, by means of the theories of the most famous and influential urban planners, it is possible to identify the major problems caused by this type of planning.

For this reason, in recent urban planning the use of systems of indicators that evaluate and certify land environmentally and energetically guides the master plan toward a more efficient city model. In addition the indicators are targeted on key factors determined by the commissioner or the opportunities the territory itself provides.

Due the complexity of the environmental mechanics, the process of design and urban planning has become a challenging issue. The introduction of the indicators system has made it possible to register the life of the process, with a spiral route that allows the design itself to be refined.

The aim of this study, built around the creation of a system of urban sustainability indicators that will evaluate highly eco-friendly cities, is to develop a certification system for cities or portions of them. The system will be upgradeable and objective, will employ real data and will be concerned with energy production and consumption.

Key words: Sustainable Development, Smart City, Assessment and Certification Systems, Sustainable Indicators, Urban Planning

RESUMO

Na sociedade moderna, o consumo de energia e o respeito pelo meio ambiente são aspectos essenciais a ter em consideração na área do planeamento urbano. A procura crescente de fontes alternativas de energia paralelamente à diminuição do sector de atividade da construção e utilização de materiais, pode dar a ideia de que estamos a seguir o caminho traçado pela escola de pensamento das cidades modernas, onde o ênfase está na redução do consumo de energia, no uso eficiente de recursos, na reciclagem de resíduos e no respeito ao meio ambiente circundante.

Analisando o desenvolvimento da cidade nos últimos séculos, através das teorias dos mais famosos e influentes urbanistas, é possível identificar alguns dos principais problemas causados por esse tipo de planeamento.

Por esta razão, no urbanismo "contemporâneo" o uso de sistemas de indicadores, que avaliam e certificam um local em termos ambientais e energéticos, orienta o plano mestre para um modelo mais eficiente de cidade. Além disso os indicadores são direcionados sobre factores-chave, seguindo a exigência do cliente ou as oportunidades dadas pelo próprio território.

Devido à complexidade dos mecanismos ambientais, o processo de concepção e planeamento urbano tornou-se uma questão desafiante. A introdução do sistema de indicadores permite registrar a vida do processo, com um percurso em espiral conduzindo ao seu aperfeiçoamento.

O objetivo deste estudo pretende a criação de um sistema de indicadores de sustentabilidade urbana que avalie as cidades altamente eco-friendly, após o que será desenvolvido de um sistema de certificação para as cidades, ou partes delas, cujas principais características serão a capacidade de ser atualizável, objetiva, usar dados reais e ter em consideração a produção e consumo de energia.

Termos chave: Desenvolvimento Sustentável, Smart City, Aavaliação e Certificação de Sistemas, Indicadores Sustentáveis, Planeamento Urbano

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LIST OF ABBREVIATIONS

SSUP: System of Sustainable Urban Planning
UN: United Nations
WHO: World Health Organization
EU: Europe Union
USA: United States of America
USSR: The Union of Soviet Socialist Republics
RPAA: Association study of American regional planning
CHC: City Housing Corporation
ICT: Information and Communication Technologies
CO_2: Carbon dioxide
WCED: World Commission on Environment and Development
UNEP: United Nations Environment Programme
ECO-SOC: UN Economic and Social Council
ECCO: European Climate Change Programme
JI: Joint Implementation
CDM: Clean Development Mechanism
GDP: Gross Domestic Product
R&D: Research and Development
EIB: European Investment Bank
EU-ETS: European Union Emission Trading Scheme
BAU: Business as usual
SET-Plan: European Strategic Energy Technology Plan
DER: Distributed Energy Resources
P2P: Peer to Peer
OECD: Organization for Economic Co-operation and Development
IS: Indicators of Sustainability
G7: Group of Seven (France, Germany, Japan, Italy, United Kingdom, United States and Canada)
PSR: Pressures -State- Response
UN – CSD: United Nations Council on Sustainable Development
DSR: Driving Forces -State- Responses
EEA: European Environmental Agency
DPSIR: Driving Forces - Pressures -State- State- Impacts – Responses
ESI: Environmental Sustainability Index
EPI: Environmental Performance Index
UNCHS: United Nations Centre for Human Settlements
CSD: Commission on Sustainable Development
STAR: The Sustainability Tools for Assessing and Rating communities

PART 1: INTRODUCTION

1.01 THESIS THEME

The theory of sustainability has developed rapidly and it is well known in the academic world. Its course of about 30 years has enabled us to deepen many theories, to explore topics poorly known until now and in opposition to the economic theories emerged in the past (Capitalism and Marxism) who saw the earth as a source of space and resources always available in the same way .

Since 1972 (Stockholm - Sweden, the United Nations Conference on the Human Environment) has begun to talk about the environment with its ability to provide resources (carrying capacity) and to absorb or not the waste from the processing of these data. The new approach to a different kind of development starts from the fact that there are constraints and biophysical limits, natural resources, absorption of pollution, demographic and carrying capacity.

The goal is to grow by meeting the needs of the present without compromising the ability of future generations to satisfy their own, through the protection of environmental resources (environmental dimension), economic growth through investment (economic dimension) and social and cultural equity (social dimension).

Most urban areas in Europe are facing a number of common issues related, not only to their physical expansion and population growth, but also to the environment and society. The noise and air pollution, the phenomenon of urban sprawl, the production of clean energy, the decarbonisation, well as social exclusion and road safety are all issues that arise in the way of a more sustainable urban development.

The imperative of sustainability has also led the European Union and other international organizations to identify and develop appropriate indicators to monitor progress towards sustainable growth. The spread of indicators, methods and models are in fact essential to support decision making in environmental matters and the last decade has developed considerable action in this regard.

1.02 OBJECTIVE

The main objective of this work is the study, development and proposal of a set of parameters that allow the creation of a simplified indicator model applicable to urban planning processes, which lead to the construction of new sustainable cities or modification of existing cities.

This work aims to define the concepts and principles of urban development in Europe and the International norms promoting to greater awareness of the importance of the evaluation of urban settlements in terms of performance and sustainability.

With the proposal of the evaluation system "SSUP", applied to the European context, this work achieves its goals, which are reflected in the presentation of a system of evaluation and certification of sustainable

urban planning. This includes the most important and relevant indicators in terms of sustainability in a simple, equitable and easy to implement in order to have a wide spread.

1.03 STRUCTURE AND METHODOLOGY

The presented thesis is divided into five chapters, the first, this introductory chapter, presents the framework to the theme, the objectives of the thesis and its organization and methodology.

The second chapter is the theoretical basis of all the work, it defines the concepts and principles of European city, describing the evolution of the concept of planning over the years. The urban typologies that have developed through the theories of famous urban planners are analysed later in this chapter. This study aims to describe the structure, evaluation criteria and regulations that have been implemented over the years. The chapter has several subchapters dedicated to fundamental events in defining the theory of urban sustainability.

The third chapter presents the meaning and the theory of the sustainability indicators. There are several subsections that describe the most popular systems used, explaining the diversities.

In the fourth chapter it is proposed the evaluation system "SSUP". Through four different Macro Areas, several categories, parameters of sustainability, their goals and individual evaluation are described. The weightings of each of the parameters defined and all the criteria, according to the degree of importance in terms of sustainability, are determined.

In the fifth and final chapter, the final conclusions on all the thesis are exposed and some suggestions are given for the future development of the system.

The completion of this thesis has been achieved through an intense collection of bibliographic information, which includes international and national publications of articles, several consulting works, researches carried out on various topics and official websites of institutions involved in certification systems.

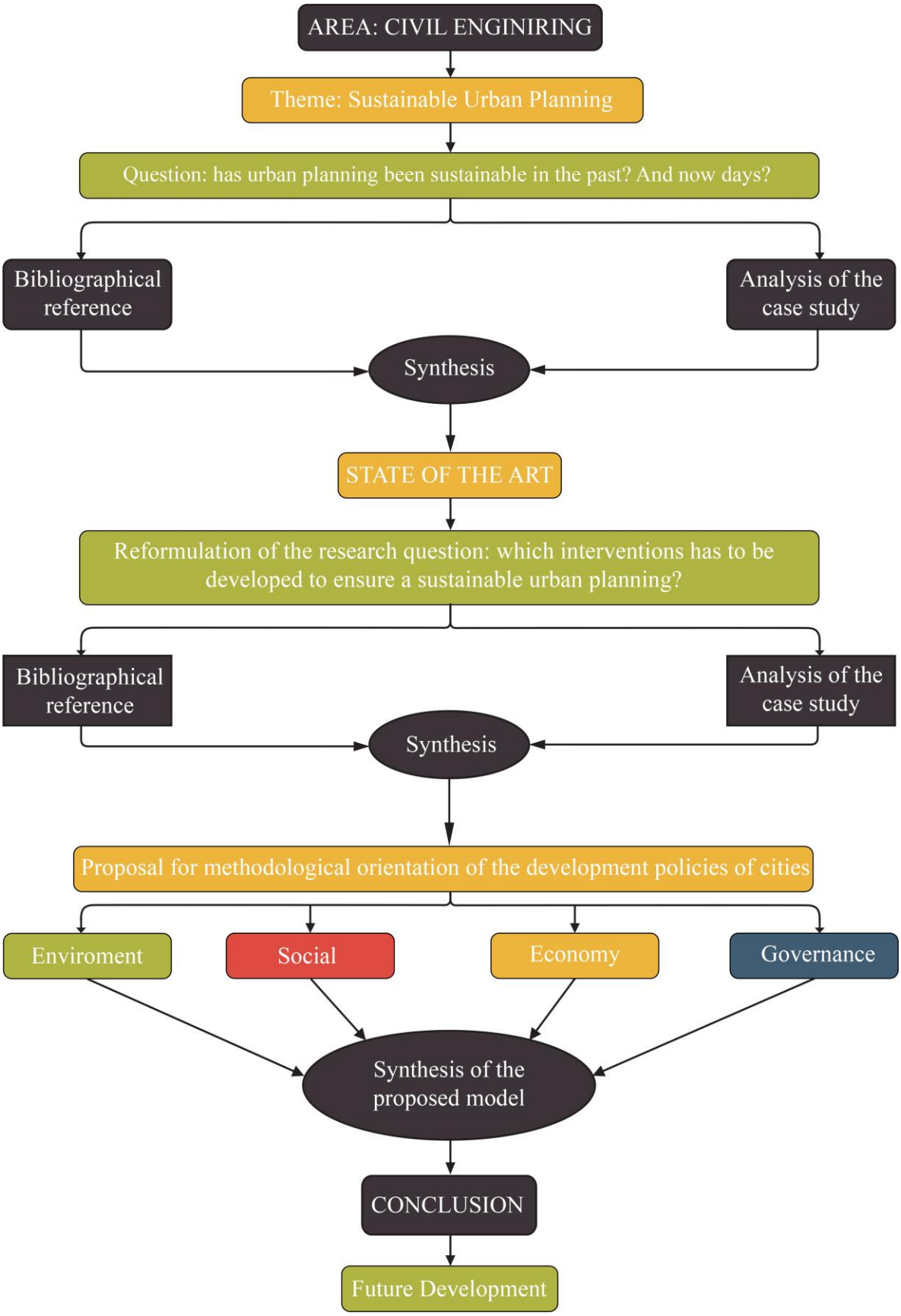

Fig 1.1: Study Methodology

PART 2: STATE OF THE ART

2.1 INTRODUCTION TO PART 2

The second part presents an analysis of the "state of the art" with the objective of acquiring and consolidating general knowledge on the subject. It describes basic concepts of city, its history and development. The use of different point of view of famous planners helps to understand the deeper analysis of the city planning used in this dissertation. All the steps associated with the study of sustainable development are described later. Also there is a deep analysis of the EU and World meetings that promotes different solutions of the urban planning. In the last step is explicated the theory that EU intends to use to promote its idea of sustainable development for cities.

2.2 DEFINITION OF CITY

Countries and cultures defines cities in different ways, the only terms that they have in common is that a city is the concept to be "a large town"[1]. The city is a stable and large human settlement, an urban area that differs from one country or a village in size, population density, importance, or legal status. Generally, a city is made up of residential, commercial, industrial and administrative areas that may also be of interest to a wider geographical area.

The city now days is considered the excellent artificial ecosystem where is possible face all the problems of the climatic changes and the urgency of the effects caused by years of excessive consumption of resources, that led the city to have to find appropriate instruments for have the least possible impact on the territory. The city is defined by Landry (2006) as a living organism that consumes food, water, energy and produces waste. This system needs to feed and regenerate glass, plastic, concrete, brick.

Directly related to the concept of city there is the urbanization. This is the process of growing of a city, it is measured by the percentage change in a city's population from year to year (Fig 2.1). Following industrialisation, large numbers of people moved to cities in search of jobs, mostly in factories, and since then there has been an unprecedented growth in the number and size of cities worldwide (Table 2.1). The international community must devote more attention to cities.

The report of UN, *State of the World's Cities 2010/2011: Bridging the Urban Divide* (2011), stimulates city planners to improve access to affordable housing and land, increase public services and quality of life. The main problem isn't the city itself, but the management and the development of cities.

[1] Oxford dictionary – city: a large town

The advantage of a city is that it has a greater population density than rural areas, which means that many people are concentrated in a small space rather than being spread out over a large territory ("low population density"). This allows the government and others to provide more services to a larger number

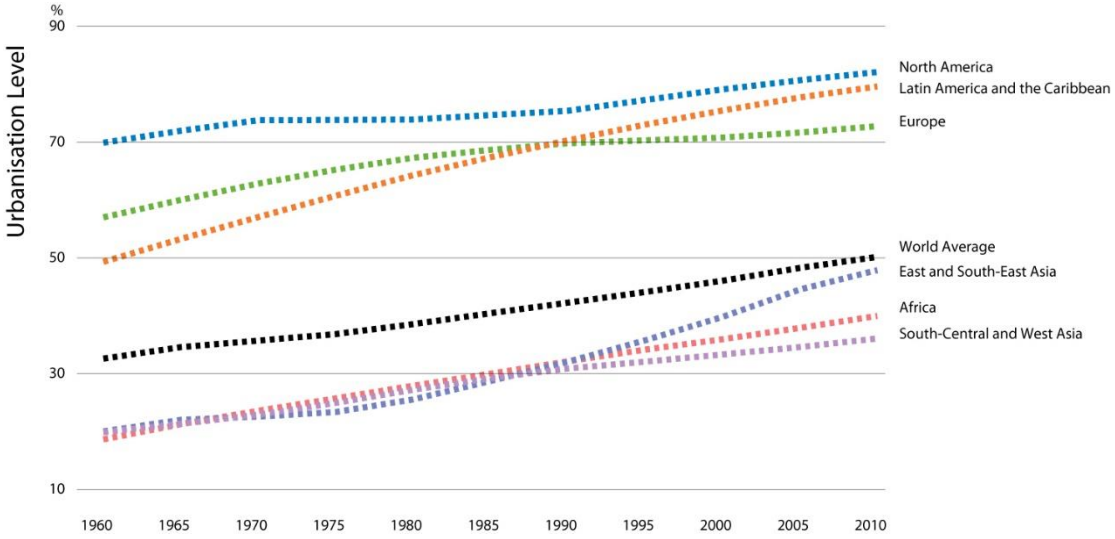

Fig. 2.1: UN Population Division (2011). World Urbanization Prospects: The 2009 Revision Population Database. (esa.un.org/unpd/wup/index.htm)

of people. One electricity line to a single neighbourhood can serve hundreds or thousands of people. Of course, this requires highly complex planning and money, which is collected through taxes. Not all citizens have equal access to what their city offers. In some areas of every city there are people without homes, without electricity and without water.

The three fundamental aspects of the growing of a city can be resumed in: "economic growth", "natural increase" and "rural-urban migration". There are exceptions to this general rule. Some cities, for example, are "created" by governments that want to take the burden off the large cities. Sometimes, such cities are made the capitals of the country, as in the case of Brasilia in Brazil, or new cities to regulate the migration from the countryside like the “ghost city” of Huanshan in the East part of China.

Urbanization can be the best solution for the future but it doesn’t solve alone all the problems. It may be the only way to deal with the massive population increase. The problem is not that cities are bad, the problem is that, with more and more people relying on the city's services and infrastructure, governments, planners and the society have to change their approach to a more smart and sustainable strategy of development.

For this reason The World Health Organization (WHO) sets some criteria for the good planning of the city; a healthy city must have:

- a CLEAN and SAFE environment
- meets the BASIC NEEDS of ALL its inhabitants
- involves the COMMUNITY in local government
- provides easily accessible HEALTH services

The United Nations Development Programme (UNDP) has outlined these priorities as part of its urban strategy:

- increasing SHELTER for the urban poor
- provision of basic urban services such as EDUCATION, primary HEALTH CARE, CLEAN WATER AND SANITATION
- improving women's access to BASIC SERVICES and government facilities
- upgrading ENERGY use and alternative TRANSPORT systems
- reducing air POLLUTION

Table 2.1: UN World Urbanization Prospects The 2009 Revision Population Database. (esa.un.org/unpd/wup/index.htm)[2]

1950		1980		1990		2000		2010		2015		2025	
City	Population	City	Population	City	Population	City	Population	City	Population	City	Population	City	Population
New York-Newark	12,34	Tokyo	28,55	Tokyo	32,53	Tokyo	34,45	Tokyo	36,93	Tokyo	38,20	Tokyo	38,66
Tokyo	11,27	New York-Newark	15,60	New York-Newark	16,09	Mexico City	18,02	Delhi	21,94	Delhi	25,63	Delhi	32,94
London	8,36	Mexico City	13,01	Mexico City	15,31	New York-Newark	17,85	Mexico City	20,14	Shanghai	22,96	Shanghai	28,40
Paris	6,28	São Paulo	12,09	São Paulo	14,78	São Paulo	17,10	New York-Newark	20,10	Mexico City	21,71	Bombay	26,56
Moscow	5,36	Osaka-Kobe	9,99	Bombay	12,44	Bombay	16,37	São Paulo	19,65	New York-Newark	21,33	Mexico City	24,58
Buenos Aires	5,10	Los Angeles	9,51	Osaka-Kobe	11,04	Delhi	15,73	Shanghai	19,55	Bombay	21,21	New York-Newark	23,57
Chicago	5,00	Buenos Aires	9,42	Calcutta	10,89	Shanghai	13,96	Bombay	19,42	São Paulo	21,03	São Paulo	23,17
Calcutta	4,51	Calcutta	9,03	Los Angeles	10,88	Calcutta	13,06	Beijing	15,00	Beijing	18,08	Dhaka	22,91
Shanghai	4,30	Paris	8,67	Seoul	10,54	Buenos Aires	11,85	Dhaka	14,93	Dhaka	17,38	Beijing	22,63
Osaka-Kobe	4,15	Bombay	8,66	Buenos Aires	10,51	Los Angeles	11,81	Calcutta	14,28	Karachi	15,50	Karachi	20,19
Los Angeles	4,05	Rio de Janeiro	8,58	Delhi	9,73	Osaka-Kobe	11,17	Karachi	13,50	Calcutta	15,08	Lagos	18,86
Berlin	3,34	Seoul	8,26	Rio de Janeiro	9,59	Rio de Janeiro	10,80	Buenos Aires	13,37	Buenos Aires	14,15	Calcutta	18,71
Philadelphia	3,13	Moscow	8,14	Paris	9,33	Dhaka	10,28	Los Angeles	13,22	Los Angeles	14,08	Manila	16,28
Rio de Janeiro	2,95	London	7,66	Cairo	9,06	Cairo	10,17	Rio de Janeiro	11,87	Lagos	13,12	Los Angeles	15,69
Saint Petersburg	2,90	Cairo	7,35	Moscow	8,99	Beijing	10,16	Manila	11,65	Manila	12,86	Shenzhen	15,54
Mexico City	2,88	Chicago	7,22	Jakarta	8,18	Karachi	10,03	Moscow	11,47	Istanbul	12,46	Buenos Aires	15,52
Bombay	2,86	Jakarta	5,98	Manila	7,97	Moscow	10,00	Osaka-Kobe	11,43	Guangzhou	12,39	Guangzhou	15,47
Detroit	2,77	Shanghai	5,97	Shanghai	7,82	Manila	9,96	Cairo	11,03	Rio de Janeiro	12,38	Istanbul	14,90
Boston	2,55	Manila	5,95	London	7,65	Seoul	9,92	Istanbul	10,95	Shenzhen	12,34	Cairo	14,74
Cairo	2,49	Delhi	5,56	Chicago	7,37	Paris	9,74	Lagos	10,79	Moscow	12,14	Kinshasa	14,54

[2] Population expressed in millions

2.03 THE CITY IN EUROPE

Europe is one of the most urbanised continents in the world. More than two thirds of the European population lives in urban areas and this share continues to grow. Europe, in the last century, develop from a rural to a predominantly urban continent. . It is estimated that around 70 % of the EU population – approximately 350 million people – live in urban agglomerations of more than 5 000 inhabitants. Europe is also characterised by a more polycentric and less concentrated urban structure compared to, for instance, the USA or China (Fig. 2.2).

There are 23 cities of more than 1 million inhabitants and 345 cities of more than 100 000 inhabitants in the European Union, representing around 143 million people. Only 7 % of the EU population live in cities of over 5 million inhabitants compared to 25 % in the USA. In addition, 56 % of the European urban population – around 38 % of the total European population – live in small and medium-sized cities and towns of between 5 000 and 100 000 inhabitants.

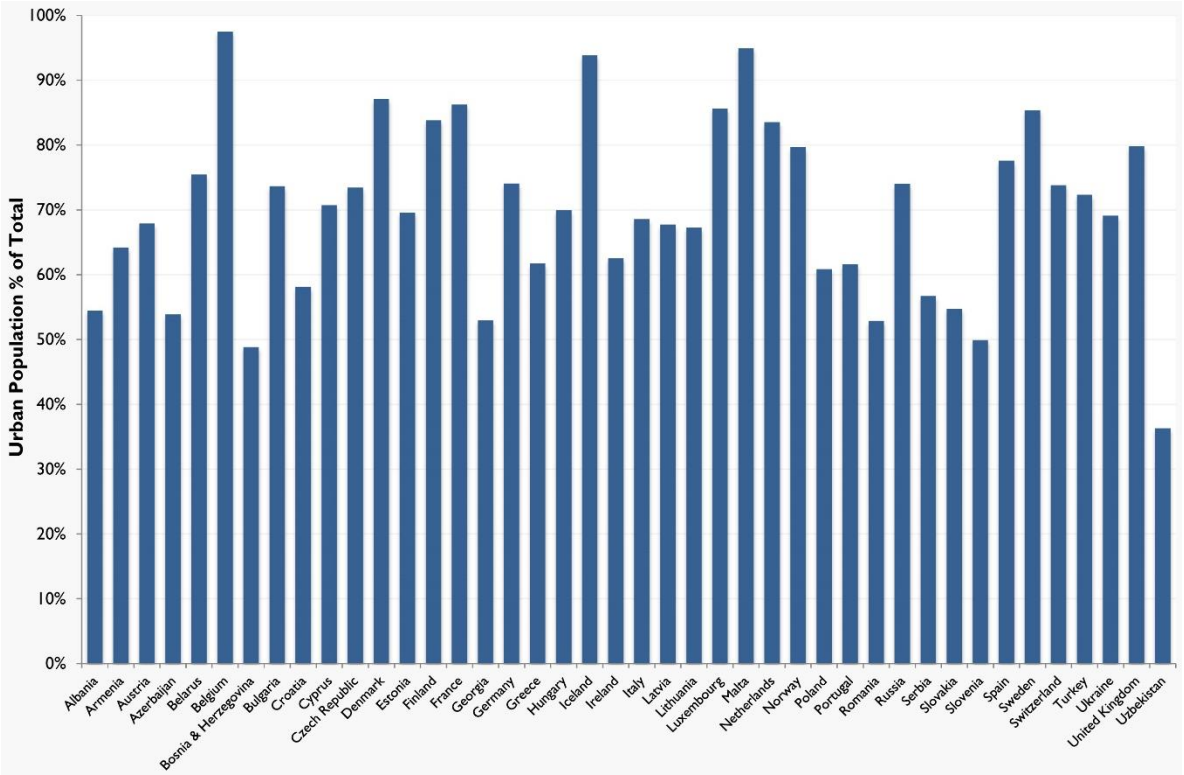

Fig. 2.2: Level of urbanization in EU (http://www.hofinet.org)

During the Informal Ministerial Meeting on Urban Development and Territorial Cohesion in Leipzig on 24/25 May 2007 the future of the European city were discussed.

“Our cities possess unique cultural and architectural qualities, strong forces of social inclusion and exceptional possibilities for economic development. They are centres of knowledge and sources of growth and innovation. At the same time, however, they suffer from demographic problems, social

inequality, social exclusion of specific population groups, a lack of affordable and suitable housing, and environmental problems." (Leipzig Charter on Sustainable European Cities, 2007)

The development of cities will determine the future economic, social and territorial development of the European Union. Cities play a key role in the lives because it also plays a key role in the social and economic development of all European territories as engines of the economy, as places of connectivity, creativity and innovation, and as centres of services for their surrounding areas. Nowadays European Commission is promoting different plans to create a model of sustainable urban development. The reason of the creation of this plan is due different causes like the demographic change, stagnation or decline of the economy, employment and social regress, disparity between social classes.

The fundamental core of Europe is its small and medium-sized cities. A large part of the urban population live in small or medium-sized cities spread across the continent. They are centres for public and private services, as well as for local and regional knowledge production, innovation and infrastructure. Small and medium-sized cities often play a pivotal role within regional economies. They constitute the building blocks of urban regions and lend character and distinctiveness to their regional landscapes. The generic features of small and medium-sized cities, particularly their human scale, are liveability, the conviviality of their neighbourhoods, and their geographical embeddedness and historical character – in many ways constitute an ideal of sustainable urbanism (Farr, 2008). Small and medium-sized cities are, therefore, essential for avoiding rural depopulation and urban drift, and they are indispensable for the balanced regional development, cohesion and sustainability of the European territory.

2.04 THE EUROPEAN MODEL CITY

European cities have developed their urban structure in the vicinity of large rivers for defensive reasons and trade, so the urbanization is a result of the industrial revolution and the development of economic activities. The urban structure results very various depending on the origin of the main cities like Athens, Rome, Venice, Paris and Amsterdam. The European city has a distinct morphological dimension: it is characterized by its compact and densely structure built around a central area (old town) where focus public buildings, churches, monuments, areas for trade and exchanges. From this centre, the city extends along the radial lines, articulated in the streets and squares.

Until the early twentieth century European cities remain thickened around their centre and organized on a relatively limited space. This common matrix creates then, in more recent times, different forms that stretch over time according to the choices of technologies for public and private transport, but also because of the action of the state authority that, in any country, let the urban form its national footprint, visible in the style of public buildings, in setting the urban planning and housing policies.

Despite this diversification, for the great majority of urban European city in terms of the structuring of the old town, it remains a powerful common meaning. Another characteristic is its longevity. In the vast majority, European cities have very ancient origins: 30% of European settlements are of Roman origin, a portion equally important has its origins in the early Middle Ages where the dispersion in the territory of monasteries and castles formed new urban centres.

One more dimension has its origins in the typical equipment of the production system of the campaign: mills, collection centres and trade markets in pre-industrial times. This means that European cities have a unique temporal continuity, which has led them to accumulate over time, buildings and institutions that make up very significant assets.

Additional elements that characterizes the European city are being part of a very dense urban system and the high incidence of small and medium- size cities. The current structure of the European urban system is bound, for one hand, on the dynamics of the process of urbanization that has led to an acceleration in the last two centuries of unprecedented urban growth, and, on the other hand, it is influenced by the existing urban structure that dates back to the Middle Ages and in large part on which urban growth is in a sense "engaged."

2.05 CERDÀ AND THE ORIGIN OF URBAN PLANNING

Cerdà[3] devoted his entire life to the study of a discipline, that no one before had ever deeper, that he called Urbanism. This name comes from the suffix Urbs (Rome in Latin), and contraction of Urbum which means plow, instrument with which the Romans use to limit the founding the area by constructing a groove, demonstrating that that land was urbanized.

Cerdà understood that cities are incomplete due to lack of sufficient resources, their forms restrictive and suffocating and they could no longer meet the needs of modern civilization. Thus began his research, doing a study to know the needs of agglomerations and acquiring in this way, the knowledge needed to formulate the basic principles of modern urban planning (1867), which he divided into four phases:

1 - Data Analysis and geography of the place.

2 - Define a program of needs and functions according to a rational classification.

1 - Analysis of the fundamental choices.

2 - Morphological expression of these choices.

Cerdà sought the origin of urbanism in the history of primitive man as the necessity to possess a refuge. The immense variety of homes that he studied, showed that the man has always looked for new ways to meet his needs, he deduced, then, that civilization and urbanization go hand in hand. Scientifically he

[3] Ildefonso Cerdà (Centelles, December 23, 1815 - Santander, August 21, 1876) was a Spanish engineer and urban planner.

defined urbanization as the totality of the repair (building blocks), the reciprocity of benefits among the inhabitants (purpose), and the ways in common use (middle) and that could be divided into three phases: Troglodyte, the Cyclops and Hovel, and which can be distinguished in them, the more types of tribe whose members lived in huts among different them, isolated and enclosed by a wall.

He found that initially these shelters were not related and that only later the family felt the need to interact building, it was then that they decided to leave around each property a path of common use; the result was a large network of public roads.

Once assured the common defence, the colonists built a large house for the big hunter. In imitation of this building, each tribe wanted her, which symbolized the moral superiority of the patriarch. When the population was large enough, the head of the colony, founded in a region near a new Urbe. Placed in different countries, with different productions, their main goal between Urbes became the exchange of products. The streets are prolonged through the countryside to allow communications. By the time the various forms of urbanization came, mixing, blending until they merge.

Cerdà's Urbes divided the world into two classes:

1 - Aquatic

2 - Those placed on land

And he wrote, in theory, each Urbe has three parts: the region, the suburbs and the urban core.

The region is the territory of any Urbe, the suburbs is represented by those groups that precede the construction of the centre, and each have a different origin. The relationship between the suburbs and the region and between them and the Urbe are regulated by the bypass roads. Finally, the urban core is the centre of the City consisting of buildings linked by a system of roads, it can be of variable size and shape depending on the limits of natural, artificial and moral.

The analytical examination of Cerdà continued with the study of roads, the building sites and finally he studied the plants of housing. The streets were analysed according to the following aspects: routing, width, pavement and lateral limits; they distinguished in the city streets and transcendental roads. Regarding the connections between roads, Cerdà took charge of their fractionation; then treated land analysing in terms of isolation, to study their shape and size. Subsequently he took charge of the house: home of the family, which he considered the big Urbe. In the third book of the Theory he wrote:

"What is home? Neither more nor less than a collection of streets and places of habitation such as Urbe. The great City, and the *Urbe-home* differ only in size and for the society in which they live." (1995).

Cerdà, once made an inventory of the constituent elements of the city, as if it was an inert bodies, compared to the urbanization man. According to him, human life was made up of two essential functions: movement and stasis. Considering these, he stated that the isolate represents the place of

residence of the individual and streets instead the communication between humans; the two are closely linked. This dichotomy, according to him, gives rise to a first allocation of space. The urbanization is both relational space and space security. In the city the dichotomy is found in the category private / public.

The purpose of Cerdà was to put in mathematical terms the problems addressed, using as an example the city of Barcelona. He chose the latter because it is the one that he knew better, also here he had the opportunity to immediately apply his theories.

According to Cerdà, cities had to be as homogeneous as possible, to ensure the equivalence of all spatial situations, public hygiene and facilitate social relations, thanks to a system of effective communication.

In 1854 in Barcelona, a sudden change of the central government allows the demolition of the walls. This was required not only by political and economic groups, but by the entire population. The Engineer Ildefonso Cerdà is responsible for drawing up the cartographic survey of the city and in 1858 a competition for the expansion involved 13 designers including Cerdà.

According to the project of Cerdà a new mesh is superimposed on the existing fabric. The ancient city is joined to the new plot pending the replacement of the old fabric. The modern city should be as homogeneous as possible to ensure the equivalence of all building lots. The innovation of Cerdà is mainly in the design of streets and blocks. The roads are 20 meters wide unless the principal axes of 60-80 mt. Isolates a side of 113 m with four chamfers of 20 meters that form the spaces of public report (squares) and facilitate the movement roadway. The build ability is initially provided by Cerdà only on two sides of the block in the different possible combinations. The 65% of the batch is intended to obtain a green settlement density of about 250 ab / ha (Fig 2.3).

Fig. 2.3: Cerdà blocks design (Cerdà. Pionero del urbanismo moderno. Ministerio de Fomento, 1998 http://urban-networks.blogspot.pt/2012/11/rompiendo-moldes-barcelona-y-madrid-se.html)

The implementation Ensanché[4] already since 1860 does not take place in accordance with the principles of Cerdà. The compliance with the texture and shape of the road blocks have become the strong point of a process of expansion that lasted decades.

The weaknesses were:

a) the process of densification, in part spontaneously in part determined by the pressures of real estate rental, which has undermined respect closed courts instead of the opened block with consequent sharp increase in building density

b) the non-implementation of many green areas and services provided

Fig 2.4: Cerdà master plan for Barcelona (Plano de los alrededores de la ciudad de Barcelona y Proyecto de su Reforma y Ensanche, 1859 http://urban-networks.blogspot.pt/2012/11/rompiendo-moldes-barcelona-y-madrid-se.html)

2.06 OLMSTED AND THE AMERICAN MODEL

In 1865, with the proposal to merge the College of California at Berkeley to the City of Oakland and the nearby hills and arranging linear park in the valley of Strawberry Creek, Frederick Law Olmsted[5] presents the idea of parkway that exposes three years after imagining integrate other parks.

His interest was not so much directed to isolated project of the park, but the continuity of public spaces, "if for each park will exploit the characteristics of the site and will take into account the limitations they impose, the result will be much more interesting and much more valuable than it would be if you follow the current setting, which tends to consider every park, big or small, as a thing in itself, which does not

[4] Ensanché: new implement of a city, usually due demographic increasing
[5] Frederick Law Olmsted (Hartford, April 26, 1822 - Belmont, August 28, 1903) was an American landscape architect and urban planner.

benefit from the relationship with the other parks and they do not give any value added "(Zapatka C., 1987).

Frederick Olmsted propagated a vision of urban green as highly topical: he caught horticultural aspects at the same time, also sanitation and economic relations around the green areas. He wrote: "Our country has entered a phase of development in which the well-being depends on comfort, safety, order and economy of the life of the big city. It cannot thrive regardless of their "(Girau L., 1988).

The actuality of the speech of Olmsted lies in the constant search for a balance between public and private spaces. Olmsted, in fact, tried to address this issue by bringing extreme care in the definition of common-use areas and areas for private use. Such attention aimed, on the one hand, to prevent the owners of individual lots intervene arbitrarily according to his wishes and the other was acting with the aim to recreate an environment that possessed a communal life is very similar to a small citizens.

In fact, the Emerald Necklace (Fig. 2.5), or the green necklace around the city of Boston, was interested in nineteen municipalities and it was configured as a continuous system of parks, green spaces for play, nature reserves, "park road" that put in communication the city centre with the southern suburbs and the non-urbanized territory, thus giving the city an urban structure extremely modern, as well as a widespread environmental quality.

The validity of this way of understanding the green in the city, or better human settlements within the natural environment, mainly resided continuously in the scheme of flexible and differentiated open green spaces. In addition, the association for environmental protection helped to give identity to the local communities with significant implications both in anthropological and sociological terms.

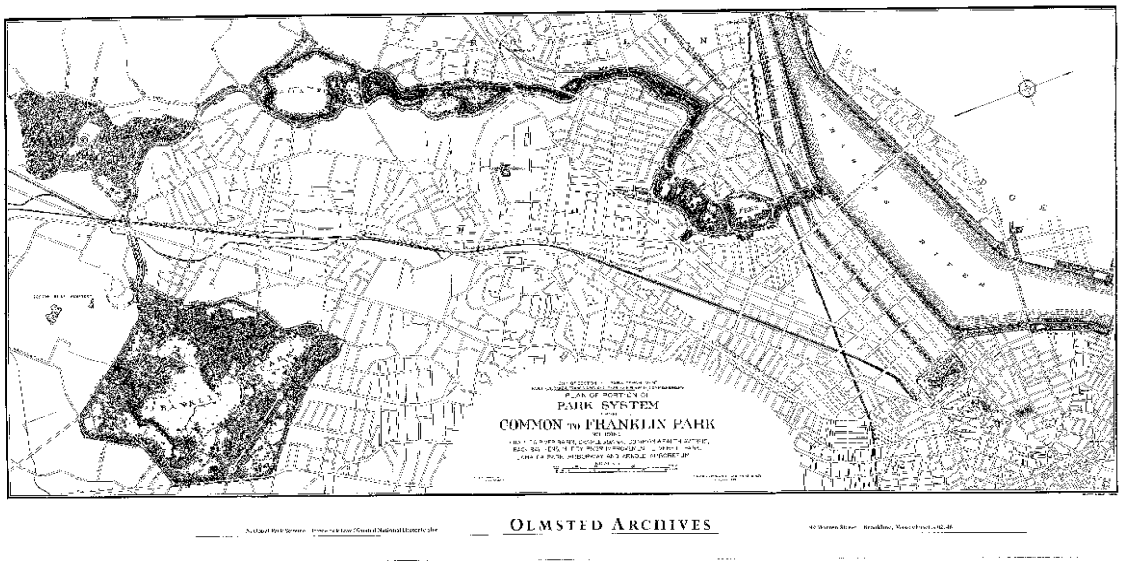

Fig 2.5: Emerald Necklace (http://www.olmstedfilm.org)

The lesson of Olmsted spread very early in the metropolitan-regional scale and then in the big cities of the United States becoming the basis of the American branch of the American Park Movement, a proponent of urban development fell within the natural realities.

2.07 LA CIUDAD LINEAL ARTURO SORIA Y MATA

Arturo Soria y Mata[6] (1844-1920) was a Spanish engineer of the same period of Howard. Initially involved in politics, later focused on the technical studies and several industrial initiatives. He was deeply concerned with the problems of urban traffic in Madrid, where in 1875 was created the first tram line.

Among the theoretical proposals of particular interest there is the "ciudad lineal", linear city (Fig. 2.6), published in 1882 in the Madrid newspaper El Progreso. Strongly critical towards the traditional congested city, developed concentrically around a centre, Soria y Mata proposed, as an alternative, a tape of limited width but of indefinite length, the path from one or more railways along the axis.

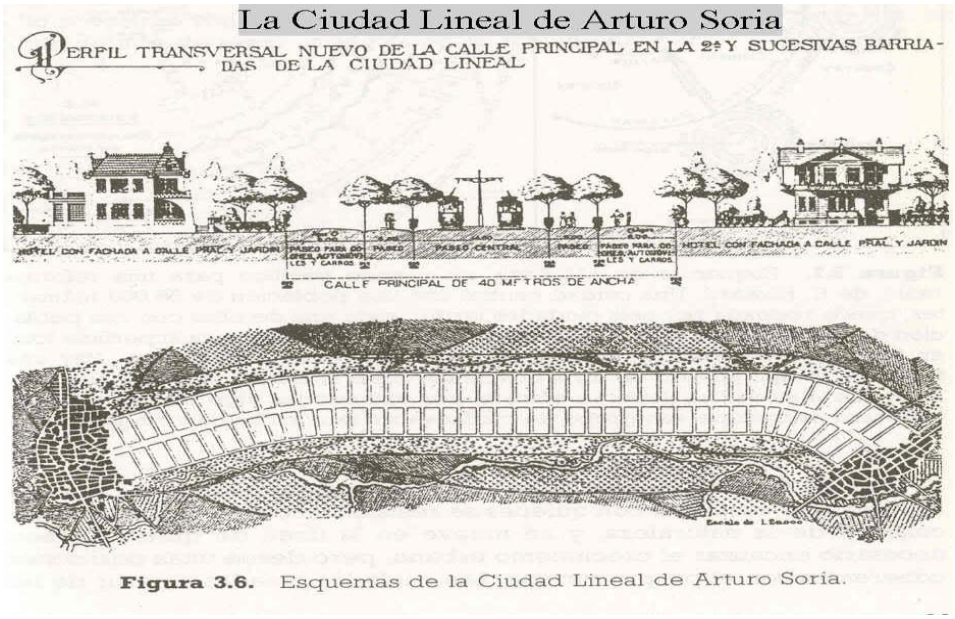

Fig 2.6: Ciudad Lineal (http://www.catedu.es/matematicas_mundo/CIUDAD/ciudad_lineal.htm)

The main road would be 40 meters wide, tree-lined and covered in the center by an electric railway (Ferrocarril); stringers would be about 200 meters long and 20 wide, buildings would only cover one-fifth of the land. Soria y Mata imagined a city of extensive isolated colony: in minimum lot size of 400 square meters, only 80 would be for housing and the remained gardens.

[6] Arturo Soria y Mata (Madrid, December 15, 1844 - Madrid, November 6, 1920) was a Spanish surveyor and town planner.

In this way, he thinks that he could solve all the problems of urbanism derived from the circulation. The project for the “ciudad lineal” comes to the conclusion, as well as Howard, who form the most logical for a city where waste less time as possible in the movement: this object is achieved thanks to the wide central road, allowing traffic flowing and smooth, and the electric railway. In addition, the city-linear has the advantage of not being limited as the garden city, but to be able to develop dynamically.

M. Ragon[7] in the "History of architecture and modern urbanism" harshly criticizes the project of Soria y Mata:

"Nevertheless the linear city had the disadvantage of not having any real center and being characterized by a great monotony, resulting from developments mechanical and not organic."(M. Ragon, 1971)

In the “ciudad lineal”, built near Madrid in the last decade of the nineteenth century, Soria y Mata tried to put into practice his model, designing a linear city horseshoe in the south-east of Madrid, 58 km long. The construction of the railway line on which to base the city was started in 1890. Soria y Mata believed that the initiative should remain in private hands and that there should be no public scrutiny; this increased however the difficulties of realization, preventing the use of land expropriation.

At the end of Soria y Mata managed to bring about a quarter of the horseshoe, but he left to private initiative freedom depriving the ciudad lineal of characters regularity expected in the theory. Later, the town was incorporated in the outskirts of Madrid, losing almost all of its original character.

The idea of Soria y Mata was taken around 1930 in the USSR, where the soil had been nationalized: his plan for the city-linear, which in truth is rather simplistic, was the basis of the urban plan for Stalingrad. The city, which stretches for 65km along the Volga, consists of six parallel bands: the river, parks, housing, circulation, green area, the railroad.

2.08 HOWARD AND THE GREEN BELT

In 1902, Ebenezer Howard[8], who first coined the term Green Belt, published the book entitled Garden Cities of Tomorrow, a great success and one of the most widely read and translated texts within the urban culture. The purpose of the reflections of Howard was to limit the growth of cities in order to reduce their crowding, improving their housing conditions and health.

[7] Michel Ragon (June 24, 1924) is a French writer, critic of art and architecture.
[8] Ebenezer Howard (London, January 29, 1850 - May 1, 1928) was an English town planner.

This objective was pursued by blocking the peripheral development of the major cities and transferring it into a crown of the garden city of limited size, separated from the central city through green belts of agricultural land. Howard thought especially about London, which even then had reached two million inhabitants; but the model was re-proposabled for any big city who knew a strong development activity and population.

The solutions proposed by Howard are placed between urban design, urban sociology, economy and agriculture. For example, some policies to address urban issues were: the decrease of population pressure on large cities, land reform to reduce the cost of urban land and facilitate the solution of the housing problem, building controlled size communities and tend to be balanced in the relationship between residence and jobs.

The urban layout of reference was particularly influenced by the design of the proposed London by John Claudius Loudon[9] in which bands of green alternated with new expansions: "Every time a citizen is going to extend beyond a diameter of half a mile, we believe that you should identify a breathing space to leave in built for the benefit of the health of the poorest part of the population" (E. Howard, 1902).

Lewis Mumford[10], who was an enthusiastic supporter of the theories of Howard, wrote in his book "The city in history":

"He understood that, once you reach the optimum, a city no longer has to further increase in area and population, but fit into a broader context that has the advantages of large number of people and equipment on a large scale."(L. Mumford, 1961).

The underestimated economic aspects of capitals confined Howard's action and he was able to achieve only two garden city: Letchworth and Welwyn also destined to be absorbed by the large macro-region of London. Howard's model was based on three concentric rings: services, residence and work that suggested a first hierarchy from the centre to the periphery; although this hierarchy was attenuated by districts, radially, moving from the periphery to the central garden. The districts were combined into a single residential system, as defined by Grand Avenue, and formed a functional and symbolic counterweight to the central park (Fig.2.7).

[9] John Claudius Loudon (8 April 1783 – 14 December 1843) was a Scottish architect and garden designer.
[10] Lewis Mumford (Flushing, 19 ottobre 1895 – Amenia, 26 gennaio 1990) was an American urban planner.

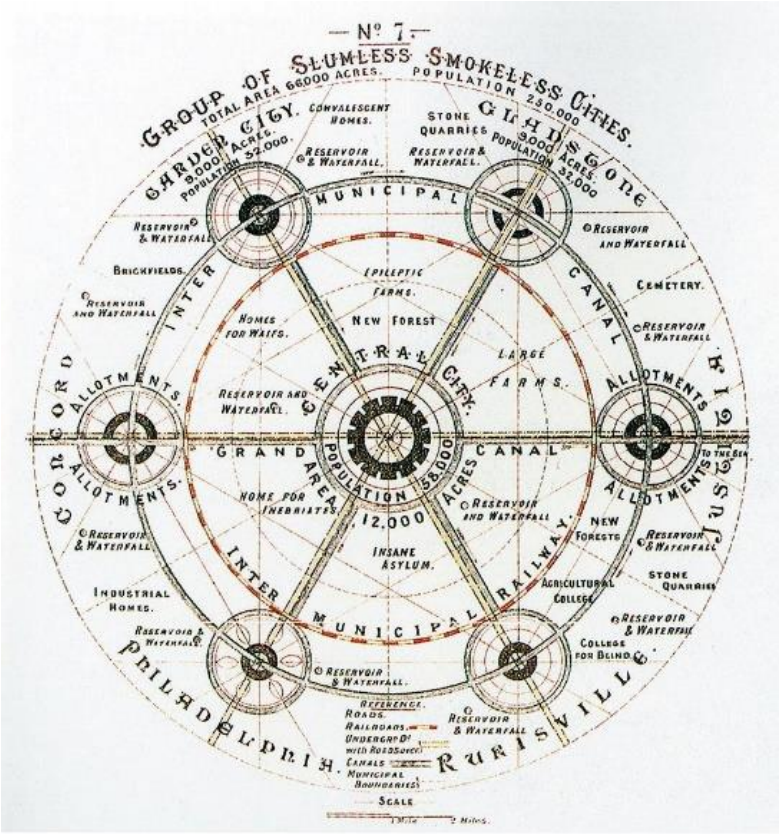

Fig 2.7: Howard Green Belt plan (https://www.pinterest.com/pin/367465650816940195/)

The attempt by Howard to build a social city resulted in the promotion of a system constantly in equilibrium because it is constituted by complementary components and cooperatives; his idea of the green belt was to be understood in the perspective of a city socially mobile: a series of small communities of up to sixty people, separated by a narrow belt of open countryside which founded a green space. The organizational model of Howard drew inspiration from a behavioural view: man is as subject to two magnets, the city, which attracted him with the lure of wealth, social relations, culture and the campaign that attracted him as a symbol of health and grandeur of nature. From this perspective, it follows, according to Howard, "that the city and the country must be married, and this joyous union will spring a new hope, a new life, and a new civilization."(E. Howard, 1902)

The aspects that are not always mentioned in the Howard's model garden city concern the agriculture. In fact, outside the railway line were placed community gardens, orchards, pasture for cows. The plan also provided some farms, as well as smaller units within which a family could live, subsisting on both the external productions with both of those fields. In addition, a market town connecting farmers and citizens. The rail network, urban inserted in the settlement, was able to make it simple and inexpensive transportation of excess products to many other destinations.

The Green Belt plays a crucial role in the Second World War when it becomes crucial counter the massive urbanization typical of those years. In 1944, in fact, during the preparation of the Plan for the Greater London, by Patrick Abercrombie, it was planned an annular band of 8 km of agricultural and forestry areas no longer permitted as construction land. The Green Belt is configured so as the third ring of a concentric series which, starting from the core of the compact city, that coincides with the centre of London, proceeding with a second ring of suburbs, and ending with the campaign outer (fourth ring) where it was planned the construction of satellite cities (new Town).

2.09 LA CITÉ INDUSTRIELLE OF TONY GARNIER

With Tony Garnier[11], urban utopia definitively separates into its two components: planning and policy. From now on, the design is neutral, allowing a burst design that will reach its climax in the activity of Le Corbusier. Often the cité industrielle (Fig.2.8) was opposed to the garden city, but in reality it has many points in common with Howard's plan, as well as with the whole tradition of nineteenth-century utopian.

Garnier gives autonomy to its economic and cultural city, reserved half of the land to public parks and planned for a population of 35,000 people; then he divided it into different zones. He imagined a chessboard, a characteristic element of the utopian tradition, and he placed, as the backbone of the cité industrielle (which will be only 600 meters wide), the electric tram, similar to what was done by Soria y Mata for his ciudad lineal, but at the same time he did not try to dilute the city in the countryside, as Howard did.
He designed his industrial city from the first to the last building, thereby focusing mainly on the technical aspects. It had two significant innovations: it adopts, for all buildings, reinforced concrete and adorned them with a style bare. In 1904 Garnier completed his elaborate and presented it in an exhibition in Paris; the work was published in 1917.

He wrotes:

"Studies of architecture that we introduce here, in a series of tables, concerning the organization of a new city, the industrial city, since most of the new city, which will be based from now on, will be due to reasons industrial order, so we considered the more general case. On the other hand in a town like this all the applications architecture can find a place with good reason, and there is the opportunity to examine them all.

[11] Tony Garnier (Lyon, August 13, 1869 - Roquefort-la-Bédoule, February 19, 1948) was a French architect and town planner.

By assigning importance to our city average (assuming that it has about 35,000 inhabitants) have always aimed for the same purpose, to conduct research in general, which would not have been justified by the study of a village or a very large city. Even with this in mind we have assumed that the land is located where all the buildings including mountainous parts and a plain, crossed by a river.

In the plains the main workshop is located at the confluence of rivers. Above it, on a plateau develops the city that is in turn under the sanitary buildings: both the city and the health care facilities are protected from the wind and exposed to the south. Each of these areas is constructed so as to be expandable in the future anyway. At the center of the city are a great stadium, the school campus and the city center. The leisure center is located on the south. All functions are strictly separated. The tram provides public transportation in the city, linking the center to the periphery, where are located the farm model. A railway also runs between the factory and the city in the valley, ensuring links with the outside world; it terminates in a central underground station. "(T. Garnier, 1904).

Garnier also prepared regulations, one for each specific sector (construction, health ...); those already gave for granted that certain changes have taken place in the social order without which there would be applicable: the administration has the free disposal of the soil and procures bread, water, meat, milk and medicines. There are no plans for barracks, nor churches, nor the courts, nor even a prison and a police station: according to all that Garnier had no reason to exist in a socialist society.

The residential neighbourhoods are made up of houses aligned in a uniform grid of streets. The land is divided into blocks of 150 meters in an east-west, and 30 meters in a north-south direction. These blocks are in turn divided into lots of 15 square meters on a side, facing then always with a part to the road. A building can occupy more than one lot, but the built-up area must be less than half of the total area, the rest is intended as a public garden. This arrangement permits to cross the city in any direction, regardless of the roads and the soil of the city, taken as a whole, is like a big park, with no fences to restrict land.

Garnier never tried to realize his “cité industrielle”, who remained only a plan on paper; however, he had the opportunity to apply his principles to a large city, Lyon, where he went to live in 1904. Garnier had a considerable influence on the thinking of the twentieth century architecture and urban planning. Michel Ragon writes:

"With twenty years in advance Tony Garnier defined what would be the" international style "and settled forty years in advance those principles of urban design that will mark the Charter of Athens (1943)."(M. Ragon, 1972).

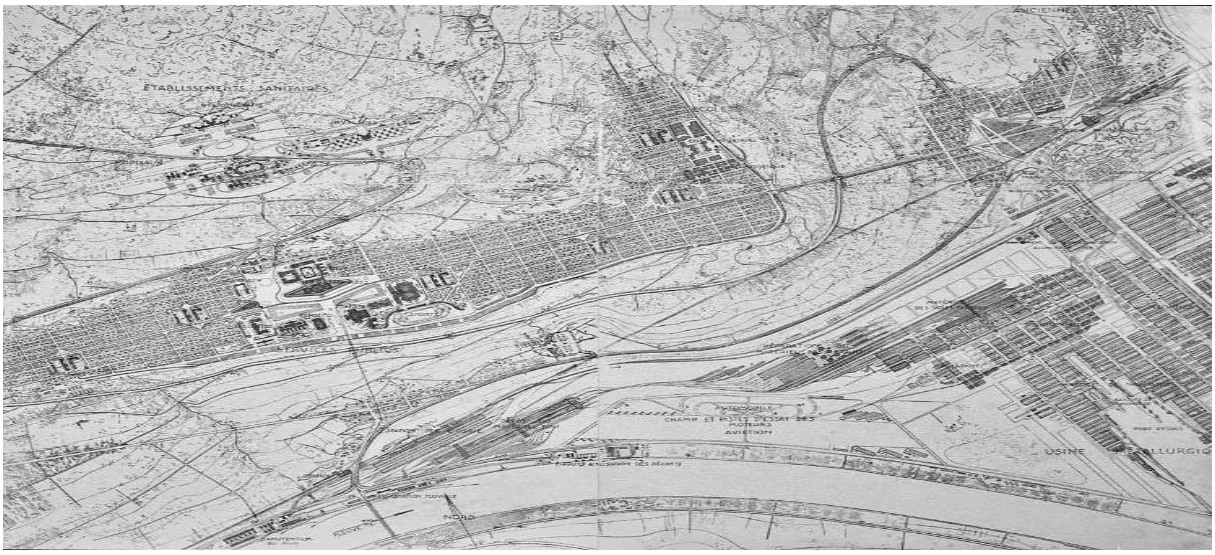

Fig 2.8: Citè industrielle (https://www.studyblue.com/notes/note/n/lecture-07-city-suburb-and-the-anti-industrial/deck/11269690)

2.10 LE CORBUSIER AND THE FUTURE VISION

After the proposals of Howard with green belts and garden cities in continental Europe, between 1925 and 1930, was spreading a theory line called rationalist which draws its principles from the above proposals of Le Corbusier[12], considered the greatest exponent of the Modern Movement. The term rationalism is meant to indicate the need to create a general vision that exceeds the specificity of places, highlighting recurring aspects of the human condition and is committed to providing repeatable solutions everywhere.

The inability to grasp the real needs expressed by the population, in reality so varied (for cultural, religious, but also the aspirations, opportunities, etc.), reducing them to a few primary functions, let Le Corbusier to propose a functionalist city, nicknamed "machine à habiter" or city car, due to the fact that there are social implications extremely limited.

The functional city, finally to address the fast-paced industrial development, the intense immigration, poor sanitary conditions, as well as the changed conditions of production due to the emergence of the capitalist model, pursues the search for appropriate technical solutions.

In the context of utopian city and city planning, Le Corbusier is one of the pioneers who introduced the idea of living in a city that is actually planned, designed and then built. He forced people to think what

[12] Le Corbusier, the pseudonym of Charles-Edouard Jeanneret-Gris (La Chaux-de-Fonds, October 6, 1887 - Roquebrune-Cap-Martin, August 27, 1965) was an architect, urban planner, Swiss-born French painter and designer.

it will be like to live in an environment that is predetermined. At the end he succeeded in actually building such kind of environment. Cities are necessarily the geographic centres of people, activities and services. The urban form and layout of cities are familiar to most people.

As with Broadacre City[13], Le Corbusier's Radiant City (Fig. 2.9) was founded on technological advances. But he rejected Howard's belief in cooperative control and Wright's admiration of individual creativity. Le Corbusier believed that only a dictatorial way of planning and design was equipped to "inaugurate the age of harmony" and dedicated his 1935 book to the discussion of this context called The Radiant City.

The most striking element of Le Corbusier's approach is his strict adherence to geometric form, regularity and standardization. In his description of "A Contemporary City of Three Million Inhabitants" he states: "The city of to-day is a dying thing because its planning is not in the proportion of geometrical one fourth. The result of a true geometrical lay-out is repetition, the result of repetition is a standard. The perfect form."(Le Corbusier, 1929)

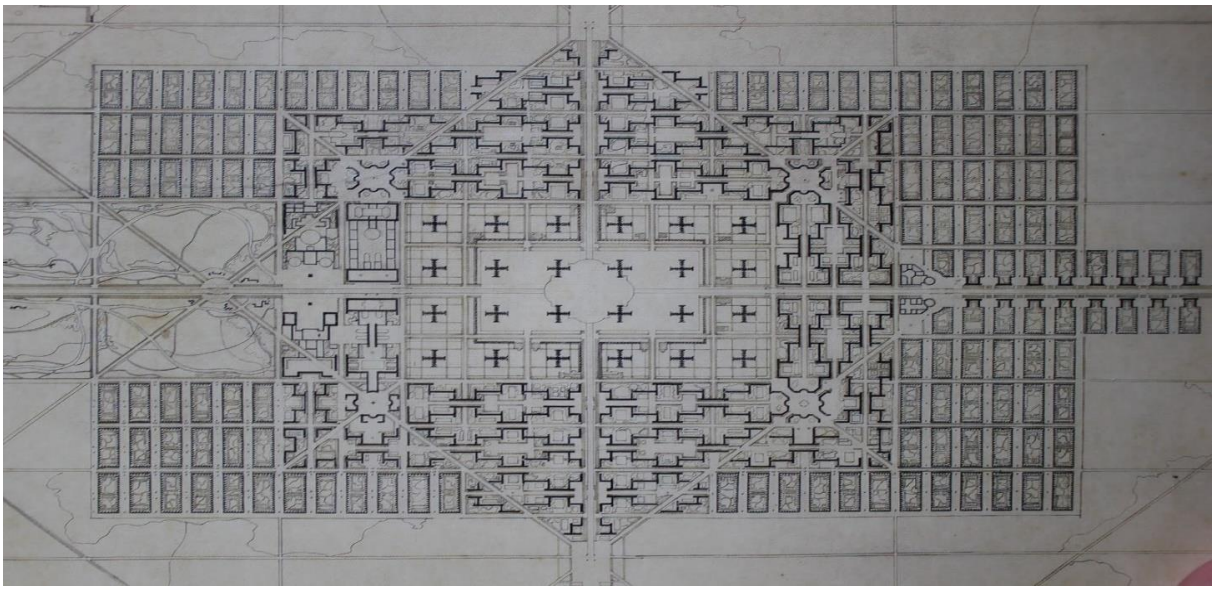

Fig 2.9: Radiant City (http://www.fondationlecorbusier.fr/)

2.11 CLARENCE STEIN AND THE AMERICAN GARDEN CITY

In 1923, Clarence Stein[14] founded an association called Association study of American regional planning (RPAA) which had the objective to introduce the concept of the Garden City of Ebenezer Howard in America.

[13] Broadacre City was an urban or suburban development concept proposed by Frank Lloyd Wright
[14] Clarence Samuel Stein (June 19, 1882 - February 7, 1975) was an American urban planner, architect, and writer, a major proponent of the Garden City movement in the United States.

For its most influential members, Stein, Lewis Mumford, Benton MacKaye, and Henry Wright, car use is associated with the national distribution of low-cost electricity and it was the topic to encourage communication, decentralization of population and industry, and finally autonomy from industrial areas.

The planners, Clarence Stein, Henry Wright realized their ideas by City Housing Corporation (CHC), a private construction company. However, the project resulted in bankruptcy and the concept did not survive the Second World War and remained on the market only the concept of "garden suburb".

Stein and Wright planned the "Sunnyside-city" or interventions related to small parts of New York, but then they wanted to create a new city in a deserted area rather than adapt to a pre-existing urban grid, in particular, they were interested in the monotonous landscapes of suburbia created precisely by the urban systems in the grid. In 1927, then it was bought by the company CHC land to build Radburn (Fig. 2.10) in Fair Lown, New Jersey 12 miles from New York.

One of the fundamental aspects of the project idea was linked to the growth of cars that occurred in those years and their relationship with pedestrians through five key points:
1 - Use of large blocks to create a single large district;
2 - A hierarchical system of roads where each type had its specific function: service lanes, roads that revolved around the super blocks, the main arteries to connect the traffic of various sections and finally highways to connect the various communities;
3 - Complete separation of paths pedestrians / vehicles and within neighbourhoods there were only footpaths;
4 - Parks within neighbourhoods as the backbone of pedestrian movement by forming a continuous system of parks;
5 - Dwellings designed in such a way that "turn" around the parks doing so lounges and bedrooms were oriented towards the pedestrian and the service rooms looked out on the streets of service.

Radburn was a sort of "neighbourhoods of education" institutions and recreational centre of development. The elementary school is located on the Northeast corner of a super neighbourhood that overlooks the park. The districts of the shops and offices are located in the middle of the city.
In fact, every neighbourhood in the initial project was meant to have the shops and primary school, but with the crisis, they failed to develop the project in full. Radburn seems to contain a mix of commercial and public recreation areas and even mix of house types which are grouped into several blocks lying around a focal point. The shopping area is surrounded by multi-family homes.

The great economic depression of 1929 limited the project that was initially intended to cover 1 miles square[15] arrived only at 149 acres and 5000 residents in 1960. Although Radburn was an innovation from the perspective of the residential but was a financial failure due the crisis lasted until World War, now days the project has become a dormitory town due the proximity to New York.

Fig 2.10: Radburn plan (https://www.pinterest.com/pin/323062973241554760/)

Clarence Stein wrote: "Although there are different reasons, the basic requirements of the defence are similar to the practical needs of the good life and the industrial economy. For peace, as well as for war, the first requirement is to spread rather than concentrate. Yet, new industrial and residential community that they had envisioned in the model of Radburn, separated by green belts and spaces for gardens, were quickly reduced to Levittown (1947) and its clones - the suburbs enormous, amorphous and infinite, dominated by mass produced homes, cars, malls, parking lots and culs-de-sac." (C. Stein, 1945).

2.12 THE MODEL OF WRIGHT

Frank Lloyd Wright[16] proposed a more thoroughly decentralized city. He proposed that "the city of the future" would be without walls, a city of the Wanderer, where mobility had brought freedom." (Fishman 1977). Wright's "Broadacre City" (Fig.2.11) was semirural, with the homestead considered the

[15] 1 mi = 2.58 km ²

[16] Frank Lloyd Wright (Richland Center, June 8, 1867 - Phoenix, April 9, 1959) was an American architect, one of the most influential of the twentieth century.

conceptual centre. Urban facilities in this proposed city were separated by vast natural and agricultural environments, and were connected through the use of automobiles and personal helicopters.

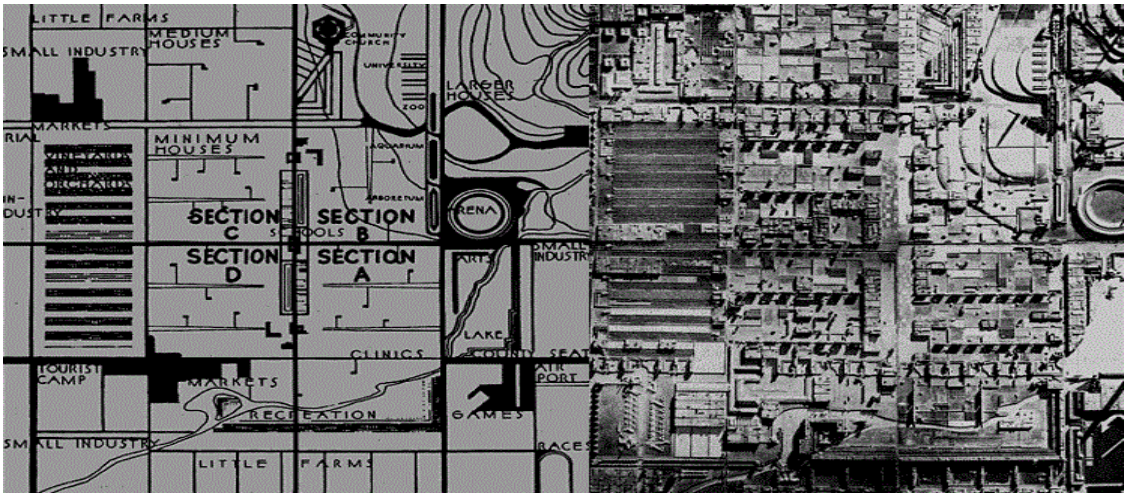

Fig 2.11: Bodoacre City (http://outlaw-urbanist.com/blog/index.php/viewpoint-theory-perfect/frank_lloyd_wright_1934-35_broadacre_city_plan_model-2/)

Wright's ideas went beyond the design of cities to proposing radical change in the way that people lived and were governed. These ideas stemmed from advances in technology which were becoming widespread at the time. Wright's believed that the increasing ubiquity of the cars and developments in electronic communication could lead to an effective dissolution of the city in favour of more widespread, decentralized communities. He proposed that all families should be allocated in a plot of land of a minimum size of one acre.

Each family would own, at least one car and most houses would contain some sort of laboratory or workshop, making working from home commonplace. The large number of houses built on small plots of land for individually owned purpose would produce an environment containing a great deal of variety. Wright thought that this would produce a distinct character underlying the individual designs at the county level but would also produce a large variety of architecture across the country. All needs and services such as food, power and education would be produced and consumed locally.

In particular, rejecting the possibility of gradual improvements of the old city, their designers reconsidered the very principles of planning, applying a completely new cities; trying to combine the spatial form with the socio-economic form of society as a whole. The three cities imagined by Ebenezer Howard, Le Corbusier, Frank Lloyd Wright represent alternative societies, utopian visions of an

environment in which man could live in peace with others, in harmony with nature and thus forms the ideal of a society industrial.

Robert Fishman, in the criticism of the proposals of Howard, Wright and Le Corbusier stated that in the seventies had lost confidence in what united the three utopians, or that the belief that the solution to an urban problem could exist in isolation:

"The city ideals of Howard, Wright and Le Corbusier were not apart from most modern solutions. They have been replaced by the belief that there are no solutions. His deep origin I believe is the loss of confidence in the reality of a good or common purpose that can become the foundation of urban life" (R. Fishman, 1977).

The composition of the city evolves over time: a spatial structure initially favourable in the economic, environmental and social conditions may evolve towards a less efficient as well as vice versa it is possible to move towards more sustainable urban forms.

The urban form has been defined by Kevin Lynch[17]:

"The shape of the settlement to which we usually refer to as physical environment is normally understood as the intertwining space of large and inert objects that make up the city: buildings, roads, public services, the hills, the rivers and perhaps the trees (...). The shape of a settlement is the spatial structure that houses the activities of the people but also the flow that comes with it."(K. Lynch, 1960).

Therefore the shape is the result of the aggregation of a number of repetitive elements that combine basic differently, giving rise to different weaves always, however, consist of the same objects and the same activities. Understandably, at this point, the belief that there is a complex relationship between urban form and sustainable development that before acting on it is possible to obtain a better quality of life.

2.13 SPRAWL CITIES

In 1937, Earle Draper of the Tennessee Valley Authority used the term "urban sprawl" for the first time during a national conference of planners. It means a kind of urban development typical of big cities, generated unwanted social effects, especially in the West Coast as main example Los Angeles.

[17] Kevin Andrew Lynch (1918 Chicago, Illinois - 1984 Martha's Vineyard, Massachusetts) was an American urban planner.

Different urban planners tried to give explications about factors of this city development. Without a specific and clear definition of "urban sprawl", Ewing (1994, 1997) organized it in five different features:

1) Development scattered and discontinuous, which leaves unused space between the built-up areas (built-up areas separated from the main urban fabric are called "leapfrog areas");
2) Development of low-density residential areas, leading to an expansion of extensive individual units with private garden that brings to the lack of public open space;
3) Linear development of commercial areas along the main transport axes;
4) Segregation of land uses: residential separates from the others, breaking the relationships between them;
5) Low accessibility to limited choice of routes and high dependence on private vehicles, mainly due to the segregation of land uses.

After few years Galster (2001) divided the sprawl into different condition of land use:

- Los Angeles is the prototype of the phenome (Fig. 9)
- is a form of unsightly development
- is a negative way of land use, social, economic and environmental costs
- is a fragment of territories
- is a continuous low-density residential development of a metropolitan area, or boundary highways, resulting so confusing

Longley tried to synthetize the term of sprawl with some features (Longley et al., 2002):

- Form: sprawl is not bound to a specific urban form, but would have a development compact or dispersed, along with contiguous urban grow linear elements (Ewing, 1994; Pendall, 1999).
- Land use: Transportation Research Board (1998) combines the characteristics of sprawl as low-density residential, single-family homes and scattered uniform, segregation of non-residential land uses (shopping malls etc...).
- Impacts: According to Ewing (1994) and Johnson (2001) sprawl leads to poor accessibility of different land uses and lack of urban space functional. In practice, define sprawl based on the costs that it entails.
- Density: the urban sprawl is associated with low-density urban development (also referred to as intensity of land use); the conception of low density, however, is relative (Longley et al. 2002).

Siedentop (2005) identifies two factors as causes of urban sprawl: the demand for land and specific regulatory factors. With demand for land he means the land consumption by households, companies and public institutions. Factors such as income, wealth, car usage define the structure of the suburbs, while the choices of location are based on comparing costs benefits. Land prices lower on the outskirts of the city, and as a consequence plus resources for transport, could push the upper classes to place their residence at a greater distance from the business.

The adjustment factors consist of specific drops in density, ways of living that tend to suburban and construction of road networks and local publicly funded infrastructure. Consistent with this vision, the planning would be the main cause of sprawl. Other factors such as dwellings of the lower classes and minorities shifted towards the centre, increased crime and reduced quality of public schools could strengthen the decentralization of the population of the upper middle class and the segregation of land uses.

Siedentrop (2005) identifies compatibility, the following impacts to urban sprawl:

- Ecological Impacts: consist in the loss of biodiversity and the natural functions of soils.
- Traffic Impacts: there is correlation between the density of the built environment and traffic. However, there are those who maintain that the density not have any direct effects on traffic, because, with the increase of residents in the suburbs, commuting radially towards the centre is gradually replaced by the cross-commuting within the urban area.
- Social impacts on health and there is a significant connection between the expansion of settlements and the concentration of poverty in the centres of the city. The degree of social interaction in the areas affected by sprawl is reduced (Putnam, 1995). On the other hand, some critics argue that the heterogeneity of social and cultural diversity in the suburbs are more than supported.

Sidentrop (2005) argues that the inhabitants of the densely built city must bear the costs of minor traffic, since the efficiency of public transport is higher than in low-density areas. Wassmer (2005) and Gleaser (2003) associate instead of urban sprawl, the need for individual mobility and therefore the use of the car, resulting in congesting traffic and an increase of energy consumption and pollution.

Other consequences are frequently mentioned in the consumption of green areas, high costs for infrastructure and energy, increasing social segregation and functional division of land uses. Wassmer (2005) also mentions the lack of functional open space, loss of agricultural land, tax expense for duplicate infrastructures, concentrated poverty, racial and economic segregation, lack of access to employment and so on.

Nevertheless, there are authors who argue that it has also positive effects. The same Wassmer (2005) promotes the higher satisfaction rating of housing, the convenience of traveling by car, filling the gap, lower crime rates and better public schools. Even Gordon and Richardson (1997) are in favour of a dispersive development method controlled by the market and claim that consumers prefer to live in low density areas, where land prices are lower and externalities such as noise and pollution are less audible.

Fig 2.12: Sprawl in Los Angeles (http://farm1.static.flickr.com/93/226438549_9f09ac15cb.jpg)

2.14 GLOBAL CITY

New York, Tokyo, London, Singapore, Hong Kong, Shanghai, ..., global cities are cities whose influence economic, political, ideological, goes far beyond their physical boundaries, as well as over those of the nation to which they belong, targeting large areas of the globe. They are huge nerve centre from where is possible to control the destiny and direction of millions of people around the world headquarters of contracting firms, manufacturers and services for banks and financial markets supported also by manual labour and low cost of the poor areas of the world.

In the past there were the city - state but these were manifestations of archaic systems integration in trans-imperial and they remained limited to small fractions of the globe. Nevertheless, the processes of urbanization accounted for a cause and a consequence of this construction system considering that the regional focal points exerted a clear dominance over the territories surrounding rural contacts and through the rivers and the sea they increased the offer of the city.

The British sociologist Anthony King (1990) is among the first to use the term “global city”, attributing to urban centres play a crucial role in relation to the new distribution of the flows of information and

capital in global economy. According to King, global cities are not a direct consequence of the trans-nationalization of the economy, but a result of colonialism.

Those, which today are global cities, have been in the past imperial cities such as Paris, London and, to a lesser extent, Madrid and Lisbon. Then centres of colonial empires were the crossroads of trade, capital and information. To these must be added those which King defines colonial cities, such as Hong Kong, New York, Sidney; cities that have played the role of political and commercial hubs essential for the control of the colonies.

The global city, in this view, is the position originally occupied by the city in the global for long centuries in history. The global city is that regardless of its size compared to the state of which it is part, and it is only by virtue of its being a node in a global network, and transnational flows of information and capital.

The broad drafting of the American sociologist Saskia Sassen (1994, 2000, and 2007) focuses on global cities as places of concentration of material goods and services which, in the global economy, have not become virtual, but they are relocated, regardless of their history, as international commercial and financial centres. These cities now operate in four ways:

(i) as business centres of organization of the global economy;
(ii) as a key location for financial services companies;
(iii) as places of production and innovation in advanced sectors;
(iv) as markets for the products and innovations they create.

From an analysis of social, economic and territorial cohesion, the author notes that New York, London and Tokyo, have more in common with each other than the State of which they are part of or even capital (Fig. 2.13).

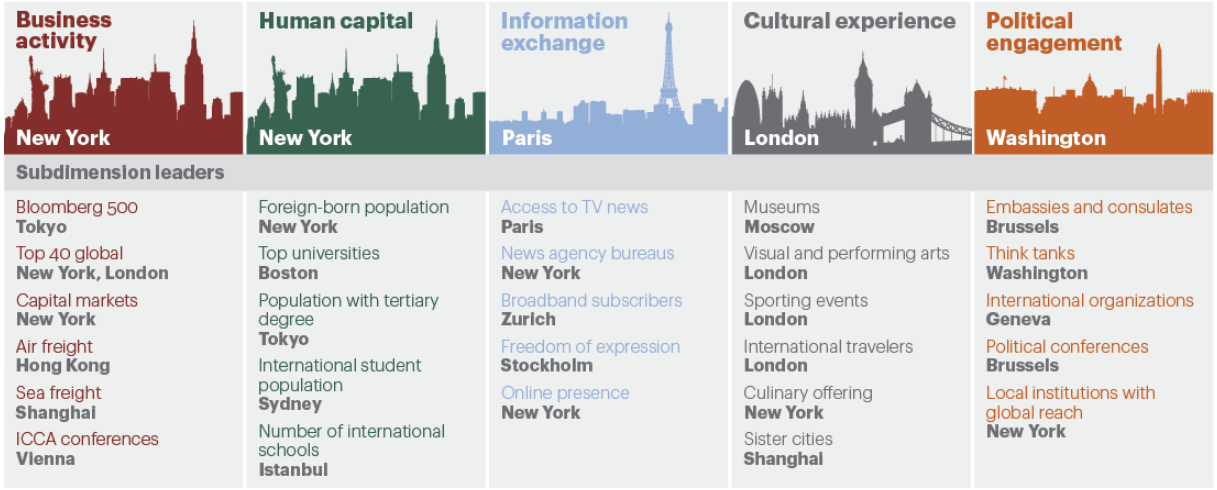

Fig 2.13: Global Cities Index (A.T. Kearney Global Cities Index)

Sassen also notes that the flows of information and capital between the three cities are most intense of the corresponding flows between each of them and the territory of the State to which they belong. It concludes that nowadays there is a formation of a transnational urban system, composed primarily of these three cities; a system in which they are gradually entering other cities that are increasingly taking on the characteristics of poly International, as, for example, Amsterdam, Paris, Sydney, Zurich and Milan. All city, those, which live mainly in a transnational dimension in where are easily recognizable increasing affinity of sociology and they have intense flows of information and capital.

The analysis of Sassen has two distinctive elements. First, the reflection is divided on the role of the state in the global economy. For Sassen is necessary a re-articulation of powers, in which the State is still a leading player in a deregulation process through which national governments allow and facilitate the trans nationalization of the economy. Deregulation is a vehicle through which a growing number of states promote economic globalization. Deregulation and related policies are the elements of a new legal regime, dependent on the consent of the States, with the aim of favouring globalization (Sassen, 1994).

This theory is emerging as a new set of powers at the global level; it is precisely this attitude that is important, for Sassen, for placing the city as a factor of production in the global economy, which is not virtualized at all, but continues to be related to contingent needs of cognitive character related to services and material production (Sassen, 1994).

The second element of the analysis of Sassen is that global cities are not only nodes exchange of information and capital, but also and above all places of relationships and social conflicts and, as such, much of the strategic ground of as the capital of global civil society (Sassen, 2000). There are a variety of organizations that work on transnational issues, such as immigration, asylum, the fight for a different kind of globalization. Although these organizations are not necessarily for urban birth and guidance, the geography of their operations is anchored in a large number of cities (Sassen, 1994).

Closely related to the elaboration of Sassen, there is the analysis of the phenomenon of global cities of the Catalan sociologist Manuel Castells, who develops his own reflection on the global cities in the moving picture, which he combines to create the network society. According to Borja and Castells (1997), the city is global by virtue of its role as a node in the global network of information flows. The system of the city has been deeply influenced by the rapid globalization of the world economy and the shift of the advanced economies from the production of material goods production, management and communication of information; an important transformation was the transition from agricultural to industrial in the eighteenth and nineteenth centuries.

In developed countries, a large majority of employment is in services, particularly those related to information and this according to percentage growth for decades. This process has further increased the importance of cities hierarchically higher, the cities in the world, even aggregating them into a single global city, a network of urban nodes at different levels and with different functions, which extends over

the entire planet and serves as the nerve centre of the new economy: an interactive system in which businesses and cities must continually adapt. The changing relationships with this network, determines, to a large extent, the fate of the cities of the network and, of course, of their inhabitants (Castells, *et al*. 2004).

Castells, therefore, extends the vision of Sassen; for him it exists a global urban system which constitutes in itself a single global city grid. In this context, the city lost its dimension of place, with its history and its socio-cultural and geographical features. Castells does not believe, however, that these features are completely dissolved in the totality of the urban system, he recognizes the existence of a tension between the global space of flows and the physical size of the city. In fact, we are witnessing a growing importance of the space of flows, establishing an electronic link between physically separate locations and creates a network of relationships between tasks and individuals, as compared to the physical space that organizes the experiences within the limits of the geographical location.

The cities are simultaneously structured and unstructured by these two approaches. The metropolis does not vanish into virtual networks, but is transformed through the interaction between electronic communication and physical relationships (Castells, *et al*. 2004). This tension means that cities are global political arenas, as a result of the emergence of social actors in them that act having for objective the acquisition of new rights.

According to Castells, the internationalization of large cities is reflected in institutional terms, the active participation of municipal governments and local development of the main architects of international life. This happens, for example, through membership of associations of cities, participation in networks, development of a national marketing and presence in international events. The trans nationalization of economic flows and cognitive, together with the reduction of the powers of the nation-state, is then drawing a new geography of global politics that dominate the urban scene is a system whose nodes are divided primarily on the basis of the needs of the economy.

The global cities are the product of a global economy and living independently from their territory. Some of these global cities do not even have its own territory or its own market, as is the case in Singapore and, at least until it was incorporated into the People's Republic of China, has been the case in Hong Kong; other global cities are found even in poor countries in the process of transformation, such as Kuala Lumpur and Mexico City.

2.15 SHRINKING CITIES

The phenomenon of abandoned housing in the United States began in the seventies occurring mainly in the districts inhabited by the poorer classes and ethnic minorities. Today, abandoning residential is no longer just a matter confined to certain neighbourhoods, but it is a feature of the urban environment of the city in particular of those that had built their fortunes thanks to heavy industry and new technologies.

The phenomenon has been emphasized throughout the international financial crisis, starting in 2006 in the United States, which has led to a global recession. In 2010 the city hits by foreclosures crisis has lost many inhabitants with respect to their peak population, the collapse has affected jobs. It follows that the districts lose part of the purpose for which they were constructed. Thus to solve this problem would not be necessary for simple neighbourhood revitalization actions, but rather a real restructuring of the city built with the aim of readapt to the new reality.

The foreclosures crisis occurs when, as a result of socio-economic changes, many of the inhabitants of a particular district are no longer able to pay off the loans for the purchase of houses. These then are foreclosed by banks and residents are forced to leave the houses.

This, accompanied in some cases by voluntary emigration to places with better living conditions, leads to a sharp depreciation of the houses. The homes that are now owned by banks are sold off by them. So also the home owners, at this point, have great difficulty in selling their properties. The neighbourhood due to the difficult selling and the consequent drop of living conditions, become very unattractive to potential new residents.

Then an urban landscape dominated by the abandonment estate was created. The real estate market in the area enters in a phase of strong inertia. The resulting problems are very serious: the abandonment of the houses is an ideal situation for criminal activity and street gangs; depopulation of districts makes it difficult to provide services to residents who remain and decreases much tax revenue for the government; the closing of business that no longer have a sufficient number of customers for their own subsistence, resulting in a deterioration of the food and health. The result is that the general deterioration of neighbourhood increases and it seems impossible to find a solution to revive the housing market area.

In some circumstances the property has been abandoned so the government decided to start massive demolition programs, rather than to meet the fees for the maintenance and care of the buildings no longer inhabited. One of the most striking is the city of Detroit, Michigan (Fig. 2.14).

At the beginning of the twenty-first century phenomenon of shrinkage is very popular in Europe. In particular, the areas affected are those of the industrial clusters in crisis in Western Europe, the sparsely populated areas in northern, rural areas of southern Europe and, even more strongly the cities of the former socialist states that have suffered a strong industrial and demographic regression after 1989.

According to statistical data related to the network Urban Audit of 220 small and medium sized European cities, 125 have lost population from 1996 to 2001; among these were 22 German, 19 Italian,

11 English and 5 in Spain. Among the 67 cities that are considered part of Central and Eastern Europe, 57 are those who have lost population.

The main cause of shrinkage in Europe is the suburbanization because it was found that almost all metropolitan areas of the city were considered to be depopulated. De-industrialization caused by the dynamics of globalization and post-Fordist economy, and the dynamics of post-socialist can be considered the most decisive reasons. Typical examples of the former industrial cities that are experiencing population declines are Turin, Bilbao, Essen and Liverpool; their situation could be compared to that of the former industrial cities of the Rust Belt of the United States, although for now the demographic decline in Europe is minor.

However, a few years ago some cities have begun to change point of view and into the myth of the growth front dynamics no longer convertible. The first attempts to deal with the shrinkage came from the areas most affected by the loss of population, particularly from East Germany, and perhaps it is no coincidence that the Germans have anticipated the rest of the Europeans in dealing with the issue. Already in 1977 in Berlin had been formed a team of architects and urban planners for the revitalization of neighbourhoods that had been devastated by the bombing. It was the first time that anyone saw in the deterioration of part of the town the ability to create quality space without having to design new neighbourhoods.

According Pallagst (*et al*., 2012) the causes of Shrinkage can be summarized as follows:

- Economic Decline
- Deindustrialization in non-competitive spots
- Old industrial areas
- Peripheral areas
- Location closures (e.g., of mining sites)
- Demographic Change
- Aging population
- Low fertility rate
- Depopulation areas
- Suburbanization
- Urban Sprawl
- Collapse of political system
- Unrest war
- Pollution
- Natural Disasters
- Climate changes

From the twenty-first century a good number of shrinking cities in Germany have begun to develop strategies to prevent further loss of population, thanks to the stimulus provided by the government through the organization of studies and conferences on the subject, to smart decline policies, financial aid for carry out the demolitions, federal policies aimed at urban revitalization and the creation of a national legislative framework cha has framed the action with some general principles.

In Europe, the general approach is different, partially due the tradition of planning; some progress has been made in East Germany where was tried, rather to create new real estate projects, the installation of green spaces for the public instead of the empty areas. In the case of Leipzig and Dresden it was tried to avoid further land use. From the Spanish case Aviles was found that the policies seek to stimulate the economy in order to rehabilitate the degraded parts of the city and to outsource the urban economic systems.

Fig 2.14: Example of shrinking in Detroit (http://www.talksparks.com/discussion/706/detroit-ghost-city)

2.16 SMART CITY

The term smart city means, in the broadest sense, an urban environment can act actively to improve the quality of life of its citizens, to meet the needs of businesses and institutions, thanks to widespread and innovative use of ICT (Information and Communication Technologies) (Fig 2.15).

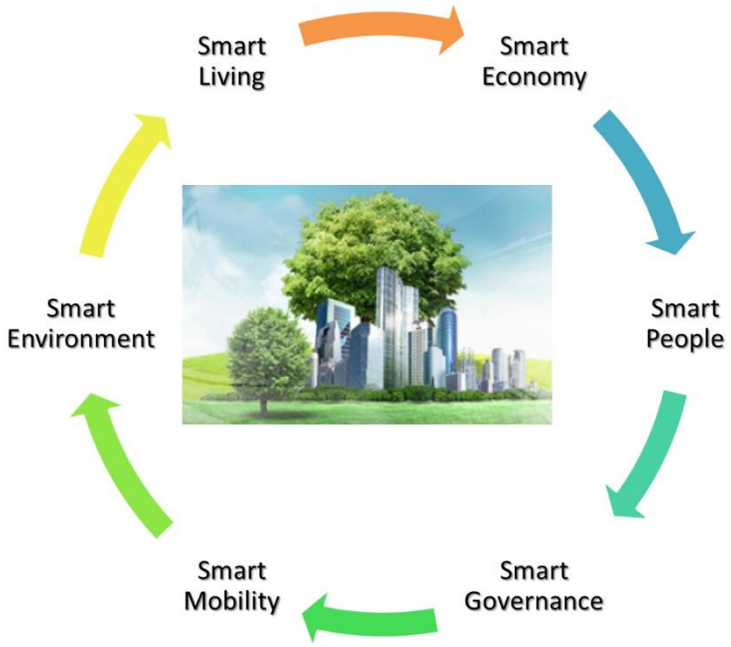

Fig 2.15: Smart City Circle (http://www.etnahitech.com/wp-content/uploads/2014/06/smart_cities.png)

The debates on the future of urban development in many Western countries are increasingly influenced by the discussions on smart cities. It appears that currently the quality of services offered by the city depends not only on the provision of physical infrastructure (physical capital), but also, increasingly, on the availability and quality of its information and communication infrastructure (intellectual capital).

The term intelligent city was introduced as a qualifier of living for urban environments where communication infrastructure integrating the most advanced technologies are combined wired and wireless terminals to devices, services and applications of cutting-edge, in order to simplify the lives of citizens and businesses, in homes, offices and public places.

The European Union has devoted sustained efforts in developing a strategy to achieve urban growth "intelligent" of its metropolitan cities.

The European Commission, in its Digital Agenda, provides special attention to the issue of smart cities, as a prerequisite for growth of the knowledge economy, social inclusion, tourism, culture and more liveable environment.

The evolution of urban reality towards smart cities is considered a driving force to maintain, if not to regain, leading positions in the world. They are, in fact, many research initiatives, not only in Europe, groups of experimentation, demonstration projects and pilot projects in the area.

The three aspects that characterize mainly the "smart" cities and territories are:

1. The relationship with citizens: cities and regions are first of all smart spaces for interaction with users. These are, at the same time, consumers of information available to them to help them in their daily lives (on travel, energy consumption, simplified access to public services ...) and producers of information through social networks and mobile services available (sharing of opinions, enrichment of knowledge bases shared ...);

2. City monitoring: at the base of the digital city is its ability to communicate with each other, the set of objects and actors that compose it, through telecommunications networks, sensors, smart objects ... Taken together, these facilities contribute to the collection and sharing of data, which is necessary in particular to the analysis of situations and city monitoring, allowing to match needed resources in order to function more efficiently;

3. New forms of cooperation: the intelligent nature of the approach is, finally, the ability to drive cross-cutting projects. This exercise promotes a dynamic dialogue involving all public actors (municipal, inter-municipal, general councils, development agencies ...) and private (infrastructure and telecommunications services, company transport, energy ...) that should lead to more developed forms of cooperation and further cost savings due to pooling.

The concept of Smart City embodies the holistic view of things, according to which the sum of the functional parts is always higher / different from the sum of the performance of parts taken individually.

In the study Smart Cities in Europe (Caragliu *et al.*, 2009) have been identified six characteristics essential for a smart city can be defined:

1. The Smart City is a city that makes use of infrastructure to enhance its economic prestige and increase economic efficiency, resulting in social, cultural and urban development. Infrastructure means business services, housing, leisure ICTs. The city is seen as a development of models and connectivity as a resource for economic growth, social and urban;

2. A smart city must have a friendly and attractive environment for new businesses, with particular attention to the development of new business activities, to promote sustainable urban development;

3. Particular attention to the Smart City must have for social inclusion, realizing, that is, the homogeneous growth in different parts of the city, and not peripheral;

4. It has a crucial role in the high-tech and creative industries for the urban development of the long-term.

5. Persons, which are living in a city, must be able to use modern technology;

6. Environmental and social sustainability, finally, are the main strategies of a smart city. The use of resources must ensure the sustainability of resources.

The main characteristics, which refer, according to scholars, to recognize a smart city concern in particular points 5 and 6, which emphasize the role of the creative class, human capital and sustainable urban development. Focusing on the concept of "Smart City" means using the word itself as a tool to share the same vision of the future,it is to share ideas and development prospects for the success of policies and projects.

The Smart City concept is, therefore, to have an idea for a new vision and shared objectives; policies and projects that focus on the reduction of CO_2 emissions, energy savings, the smart way to use the resources of a city. Objectives that must be provided in an integrated planning and sustainable low-carbon, low-energy buildings, use of slow mobility, policies for sustainable mobility.

The Smart City concept also wants to draw a shared vision of the future, through the development strategies for the city. The highlight of the Smart Cities is to have an integrated planning, cooperation between different sectors are the key elements to tackle the problems of planning today, such as the fragmentation of the different administrative parts of the city in the first place and as a result of the physical city of policies and projects later.

The European Union is beginning to promote the concept of Smart City just to encourage cooperation and integrated approach between the public and private sectors.

2.17 DEFINITION OF SUSTAINABLE DEVELOPMENT

The rapid increasing of the standard of life of a part of human societies related with the growth of the global population caused the consumption of resources, especially natural ones, with serious effects on the global environment. The necessity to preserve the habitat from the wasting request new theories and solutions for a better development of the society.

The first time that the International Community started to think about change the dependence of nations from oil to renewable sources was at the beginning of the 1970, when after the war between Israel and Arabs nations, there was a less export of oil from the Saudi Arabia to the Europe as a political protest. In the same period a group of researchers of the Massachusetts Institute of Technology, commissioned by the Club of Rome published the report “Limits to Growth” (1972).

The result of the research was that the interactions between the increasing of the world’s population, industrialization, pollution, food production and resource consumption would lead to unlimited consumption energy and environmental resources. It was too suggested a way of a type of development that would not lead to the total consumption of the planet's resources.

In June 1972 the UN Conference on the Human Environment took the ideal of a model of economic growth that doesn't consume all the natural resources and made them available for the future.

Sustainable development was defined so for the first time in 1987 by World Commission on Environment and Development, headed by Gro Harlem Brundtland, Prime Minister of Norway. In the final report entitled "Our Common Future", also known as the Brundtland report, sustainable development is defined as:

"Development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

In other words, development is needed to satisfy human needs and improve the quality of life, but at the same time it must be based on an efficient and responsible use - from an environmental point of view – of the scarce resources of our society, being them natural, human or economic.

The key concepts of sustainable urban development it is possible to synthesize in (Fig. 2.16):

• Economic efficiency: to be pursued through the efficient use of resources, the internalisation of social and environmental costs;

• Protection and enhancement of natural resources through the minimization of impacts and the levy of environmental resources (especially if you do not renewables);

• Social equity: intended as an equitable access to resources and opportunities.

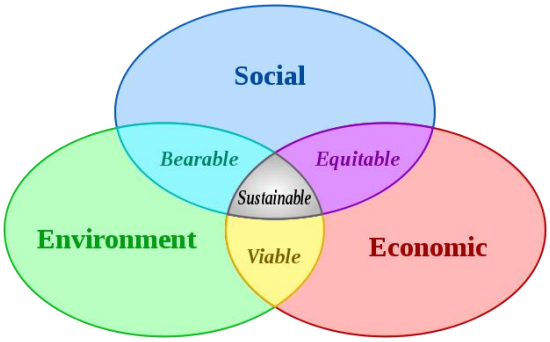

Figure 2.16: Key concept of sustainable urban development (http://www.wfs.org/content/what-sustainable-development)

Talk about urban sustainability is equivalent to prefigure a city model capable of running with the least expenditure of energy, the use of clean technologies, to recycle their waste efficiently while keeping within the limits of eligibility level of environmental impacts generated.

However, it is important to highlight how these dimensions are closely interrelated to each other by a multiplicity of connections and, therefore, should not be considered as independent elements, but must

be analysed in a systemic vision, such as elements which together contribute to the achievement of a common end. This means that any intervention program must take account of mutual interrelationships. In the case in which the planning choices privilege only one or two of that dimension, does not occur sustainable development.

In June 1992, twenty years after the UN Conference on the Human Environment, it was held in Rio de Janeiro, the UN Conference on Environment and Development, and another step forward emerged from the Brundtland Report.

At the end of its work, the Conference adopted by consensus:

1. The Rio Declaration, consisting of 27 principles on the integration of environment and development;

2. Agenda 21, a comprehensive program of action into 40 chapters that identifies the objectives of sustainable development and the steps needed to achieve it;

3. Declaration of Principles, which are not legally binding for a global consensus on the management, conservation and sustainable development of forests.

2.18 AGENDA 21

Agenda 21 is the document signed by 180 countries at the conference in Rio de Janeiro in 1992. It was called Agenda 21 because it defines "things to do" for the 21st century: goals and strategies of reference towards sustainability. To achieve sustainable development, the document strongly emphasizes the need:

• Integration of environmental considerations in all structures of the central government and all levels of government;

• System planning, control and management to support this integration;

• Encouragement of public participation and stakeholders.

Also in 1992, was established a Commission on the Sustainable Development, as part of the UN Economic and Social Council (ECO-SOC) and each year participate in the work of over 50 ministers and more than 1,000 non-governmental organizations. It is the official home of the international debate on sustainable development in terms of both policy and operational and it is the reference to understand what the international community intends to sustainable development (Fig. 2.17).

In 1997, the General Assembly of the United Nations held a special session to assess progress in the first five years of the approval of Agenda 21 (Rio +5). The Assembly recognized the nature of disparities of progress and it identified the characteristic features, including increasing globalization, which expand income inequality and continue environmental degradation. A new General Assembly resolution

promised new actions[18]. Subsequently, the Plan of Implementation, agreed at the World Summit on Sustainable Development (Earth Summit, 2002), confirmed the commitment of the United Nations for the full accomplishment of the Agenda 21 along with the achievement of the Millennium Development and other international agreements.

Agenda 21 is a new management tool for governance policies for sustainable development, considered a priority by the European Union and the UN after the conference in Johannesburg in 2002.

At European level, the objectives of Agenda 21 have been introduced in policy documents and planning in the member countries of the European Union. The Fifth Environmental Action Programme 1993-2000, "Towards sustainable development" recognizes the need to develop approaches to achieve sustainable development. The VI Program, Environment 2010: "Our Future, Our Choice", emphasizes the importance of new forms of participation of citizens, businesses and local youth through local Agenda 21 processes. On the basis of the appointment of the "Rio +10", the European Commission published a communication to the Council and the European Parliament entitled "Ten years after Rio : Preparing for the World Summit on Sustainable Development in 2002" , which shows the priorities of the EU for sustainability.

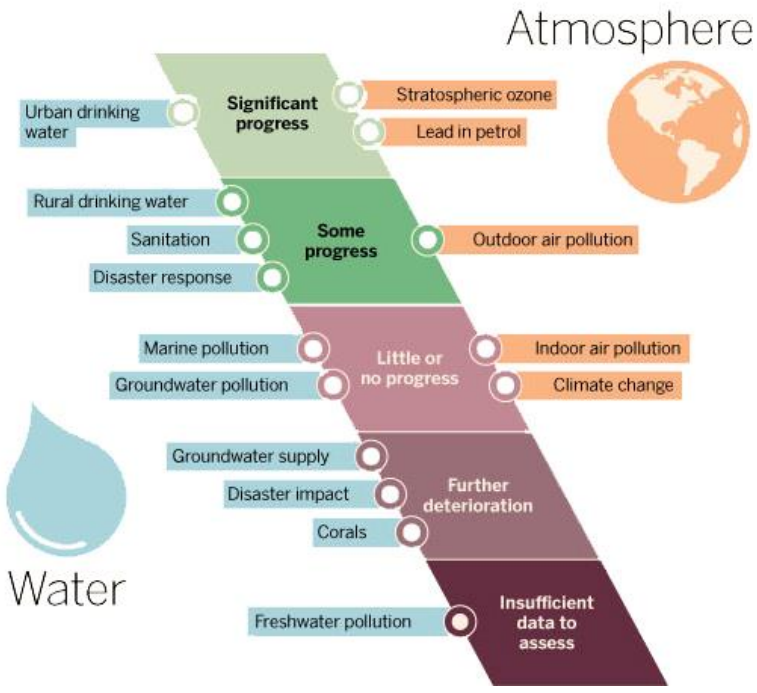

Fig. 2.17: UN Environment Programme ratings from Rio 1992 (UNEP http://www.unep.org/)

[18] United Nations General Assembly, Resolution S- 19/2 of 28 June 1997.

2.19 AALBORG CHARTER

In response to the results of Rio de Janeiro in 1992, that encouraged to revise the model of development with a view to greater social, economic and environmental, some European cities have promoted, with the support of the European Union, the first Conference on Sustainable Cities & Towns in Aalborg (Denmark) in May 1994.

This conference was particularly significant because it led to the formulation of a charter of commitments where defined the concept of sustainability and which bound the 80 signatory local authorities to prepare its Local Agenda 21.

The European Sustainable Cities and Towns Campaign, founded by the Aalborg conference, has as main purpose the promotion and diffusion of Local Agenda 21 in European cities, serving as a place for the exchange of information, experiences, ideas and research of transnational partners for initiating projects and twinning.

The Charter of European cities for sustainable development (Aalborg Charter) was adopted by 80 European local governments and 253 representatives of international organizations , national governments, scientific institutions , consultants and individuals who participated in the European Conference on sustainable cities.

By signing the Charter, cities and regions of Europe have committed themselves to implement Agenda 21 at the local level, to develop action plans in the long term and to undertake the campaign for sustainable development of European cities.

The Aalborg Charter elaborates the concept of sustainability, identifies the responsibilities of the urban environment and committed to develop policies and positive action to move towards sustainable cities.

The cities recognize their own responsibility, due the current urban lifestyle, in particular the patterns of division of labour and functions, land-use, transport, industrial and agricultural production, consumption, leisure activities and then standard of living, with regard to many of the environmental problems that humanity is facing.

Pose among its objectives: social justice, sustainable economies and environmental sustainability. In particular, for environmental sustainability level means:

• preserve the natural capital;

• prevent the rate of emission of pollutants exceed the capacity of the atmosphere, water and soil to absorb and process them;

• conserve biodiversity, human health and the quality of air, water and soil.

The task of the city is to integrate the principles of sustainability in their policies from its own resources, to build locally appropriate strategies.

The city recognizes that:

• Sustainability is a local creative process aimed at achieving a balance that embraces all areas of local decision-making;

• It will have to invest in the conservation of the remaining natural capital and promote growth;

• It will have to invest in order to reduce the pressure on natural capital such as expanding green spaces for recreation in the city;

• It will have to improve the efficiency of end-use products for example by using efficient buildings in terms of energy and urban transport mode is not harmful to the environment.

In addition, the city recognize the importance of the adoption by local authorities of efficient land-use and development policies that include a strategic environmental assessment of all projects.

To this end, they:

• provide public transport and energy efficiently thanks to the high urban density;

• will aim to develop a variety of functions to reduce the need for mobility in the implementation of programs of urban renewal and planning of new neighbourhoods;

• will balance the flows between city and countryside.

To improve accessibility and sustain social welfare and style of urban life while reducing mobility, cities commit themselves to:

• reduce forced mobility and discourage the unnecessary use of motor vehicles;

• give priority to environmentally friendly means of transport (in particular walking , cycling and using public transport) and put at the centre of our planning efforts a combination of those means ;

• give individual transport an auxiliary function.

The city also undertake to comply with the recommendations of Agenda 21 and to develop them at a local level in partnership with all sectors of our society: citizens, businesses, interest groups.

Finally, the city will move forward together towards a sustainable model through a process of learning from experience and good local examples. The main initiatives will seek to:

• facilitate mutual support for the design, development and implementation of policies towards sustainability;

• collect and disseminate information on good examples at the local level;

• promote the principle of sustainability in other local authorities.

On 11 June 2004, the 1,000 participants at the Fourth European Conference on Sustainable Cities & Towns, Aalborg +10, approved the Aalborg Commitments recognizing them as the final declaration of the conference, and representatives of 110 local governments have signed the document. This positive response so immediate strengthened the optimism and certainty that the Aalborg Commitments will be able to develop a considerable positive energy goes in favour of sustainability.

The Aalborg Commitments are designed to give greater impact to the actions of local sustainability, and to provide new impetus to the process of Local Agenda 21. It proposes two key objectives:

1. Raise awareness and highlight the need for local governments across Europe to implement integrated policies able to meet the growing challenges of sustainability.

2. Be practical and flexible.

2.20 THE KYOTO PROTOCOL

The Kyoto Protocol, signed in the Japanese city Kyoto on 11 December 1997, is certainly the most important international treaty on the environment and it is the implementation tool of the General Assembly of the United Nations.

The Protocol contains a commitment of 160 industrialized countries to reduce emissions of pollutants by at least 5 % in 2008-2012 compared to 1990 levels. The European Community has played a key role in the positive outcome of the negotiations on the Kyoto Protocol, signed it April 29, 1998. The EU Member States have committed themselves to deposit their instruments of ratification simultaneously with the Community before 1 June 2002[19]

The European Climate Change Programme (ECCP), launched in March 2000, is the main instrument of the Commission's strategy for the implementation of the Kyoto Protocol. The purpose of the ECCP and all concerned is to identify and develop effective measures from the point of view of costs that contribute to the achievement by the EU, the objective of 8 % set by Kyoto.

Member States are in fact called to achieve this objective, valid also for the states that joined the EU after 2008, by 2012. Exceptions are Poland and Hungary that have an obligation to reduce emissions to 6 %, while Malta and Cyprus constitute the framework agreement.

[19] 2002/358/EC : Council Decision of 25 April 2002 concerning the approval of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder ;

The protocol, however, is only entered into force in 2005, when Russia also ratified it (Fig. 2.18). For its entry into force, in fact, it needed to be ratified by at least 55 Parties to the Convention, including industrialized countries responsible for at least 55 % of the emissions of carbon dioxide in 1990. There is certainly important is the absence of the United States and Australia. China, India and emergent economy countries ratified the protocol but are exempted to respect the objectives because are not considered responsible for the climatic change.

Fig. 2.18: Kyoto Protocol countries ratification at 2005

(https://globalwarmingdisaster.files.wordpress.com/2008/11/kyoto_protocol_participation_map_2005.jpg)

As previously mentioned, the Kyoto Protocol, a major action against climate change because it sets binding targets for Member Subscribers and quantified emission limitation and reduction of greenhouse gas emissions following:

- Carbon dioxide (CO_2);

- Methane (CH_4);

- Nitrous oxide (N_2O);

- Idrofluorocabure (HFC);

- For fluorocarbons (PFCs);

- Sulphur hexafluoride (SF_6)

To achieve the reduction targets has been introduced three "flexible mechanisms" based on the market: the exchange of emission allowances, joint implementation and the sustainable clean development mechanism.

The trading system provides, with the establishment of limits on CO_2 emissions from energy-intensive companies, the releasing of quotas of carbon dioxide between companies. If a subject obtains reductions of emissions below the set limits, the remaining shares will be sold to companies that have difficulties to comply with the limits or for which the measures relating to the reduction of emissions are much more expensive. This system aims to encourage firms to innovate and to lead them to reduce emissions where they are cheapest, thereby ensuring that reductions are made at the lowest possible cost to the economy.

The concept of "Joint Implementation" (JI) projects regards countries with emissions targets , while the clean development mechanism (CDM) projects concerns to developing countries, that haven't fixed objectives. In order to be granted credits for reductions achieved, the project should generate benefits in terms of real climate change, measurable and in long-term. The JI and CDM are similar to those of the exchange of emission allowances and are based on the principle that if climate change is a global problem, it does not matter where emissions are being cut, what is more important is that this is done with minimal effort or loss. The JI and CDM are also particularly interesting because they permit the transfer of technology to countries with economies in transition (JI) and the Developing Countries (CDM), helping them to move towards a more sustainable development model.

2.21 LISBON AND GÖTEBORG STRATEGIES

Meeting in Lisbon in March 2000, the Heads of State and Government of the European Union had launched the objective of making Europe the most competitive knowledge -based and dynamic economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion by 2010.

The Lisbon Strategy was based on a series of structural reforms in the areas of employment, innovation, economy and social cohesion, but still it had not taken account of environmental sustainability.

Only after the Göteborg European Council in 2001 and at the World Summit in Johannesburg in 2002 the concept of sustainable development gained new momentum.

In Gothenburg it was definitely established that the priority in economy and environmental policies should go hand in hand; for that reason the Council formulated a strategy for sustainable development, thus establishing the value of the cross-environmental policy.

The Göteborg Strategy has integrated, with a new approach to policy-making, to the Lisbon Strategy a third dimension to economic and social: environment. Sustainable development must be seen as a broader concept, able to show that long-term economic growth, social welfare and environmental quality go hand in hand.

The Strategy identifies problem areas so that the Union must be able to know how to deal with them. In particular there are:

1. The fight against climate change : the commitment to achieve the goals are set by the Kyoto Protocol and to comply with the objective of increasing by 2010 the consumption of renewable energy to 20 % compared to gross electricity consumption ;

2. Ensure the sustainability of transport: namely the commitment to adopt by 2003 a review of the trans-European networks and to ensure that by 2004 the prices of transport better reflect the costs to society;

3. Manage the natural resources more responsibly: the commitment to change the relationship between economic growth, resource use and waste production, the adoption of an integrated product policy, stop the decline of biodiversity by in 2010.

While so, the EU reiterates the importance of the local dimension in the field of sustainability, on the other hand it is also proposed, itself, as a driving force in the world. In fact, the strategy should be a guideline in international collaborations to promote sustainable development at world level.

2.22 EU 2020 STRATEGIES[20]

After the crisis that swept through Europe in 2008, it were thwarted years of economic and social progress. Meanwhile, the world is rapidly transforming and long-term challenges such as globalization, pressure on resources and aging is becoming more evident. For this reason the European Commission worked to study a recovery strategy that could give new impetus to the member states through a smart, sustainable and inclusive economy delivering high levels of employment, productivity and social cohesion.

2020 has three mutually reinforcing priorities:

- Smart growth: developing an economy based on knowledge and innovation;

- Sustainable growth: promoting a more resource efficient, greener and more competitive economy;

- Inclusive growth: fostering a high-employment conducive to social and territorial cohesion.

With the following objectives:

- 75% of people aged between 20 and 64 years must have a job;

- 3% of the EU's GDP should be invested in R&D;

- The "20/20/20" on climate / energy targets should be met (including an increase of 30 % of emissions reduction if the conditions are right);

- 20 million less people should be at risk of poverty.

[20] Bruxelles, 3.3.2010 COM(2010) 2020

These goals are related to each other and critical to EU overall success. To ensure that each Member State reach the Europe 2020 strategy, the Commission proposes that EU goals are translated into national targets and trajectories:

- An efficient resources to help decouple economic growth from the use of resources, support the shift towards a low-carbon economy, increase the use of renewable energy sources, modernize our industry transport and promote energy efficiency.

- The fight against climate change, in order to achieve the objectives of Europe, must reduce emissions much more rapidly in the next decade than in the past and to fully exploit the potential of new technologies, such as the ability to capture and secure CO_2. A more efficient use of resources would significantly contribute to reducing emissions, to save money and boost economic growth. This affects all sectors of the economy, not just the high emission intensity. It should also increase the strength of our economies to climate risks, as well as our ability to disaster prevention and disaster response;

- Clean and efficient energy: saving € 60 billion of oil and gas imports by 2020. Integrating the European energy market could add a further 0.6% to the 0, 8 % of GDP. The only achievement of the EU target of 20% renewable energy could create more than 600 000 jobs in the passing over 1 million if you add the 20% target with regard to energy efficiency.

- Mobilize EU financial instruments (rural development, structural funds, R & D framework program, TENs, EIB, etc. . .) as part of a consistent funding strategy, that pulls together public and private funds of the EU and national;

- To strengthen the framework for the use of market-based instruments (exchange of emission allowances, revision of energy taxation, state aid framework, encouraging wider use of green public procurement, etc.).

- To make proposals to modernize and "decarbonise" the transport sector thereby contributing to increased competitiveness. This objective can be achieved through a package of measures such as the rapid development of grid infrastructures of electrical mobility, intelligent traffic management, better logistics, the further reduction of CO_2 emissions for road vehicles, aviation and maritime sector, including the launch of a major initiative for European cars 'green' which will help to promote new technologies, including electric and hybrid cars, combining research, development of common standards and developing the necessary infrastructure support;

- To accelerate the implementation of strategic projects with high European added value to address critical bottlenecks , in particular cross-border sections and intermodal nodes (cities, ports , logistic platforms);

- To complete the internal energy market and implement the Strategic Plan for Energy Technology (SET); another priority would be the promotion of renewable energy in the single market;

- To present an initiative to strengthen the European networks , including trans-European networks in the energy sector , turning them into a European super grid, in "smart grids" and interconnections in particular of renewable energy sources with the network (with the support of the Structural Funds and the EIB) . This includes the promotion of infrastructure projects of major strategic importance for the EU in the Baltic, the Balkans, the Mediterranean and Eurasia;

- To adopt and implement a revised Action Plan on energy efficiency and promote a substantial program for the efficient use of resources by using the Structural Funds and other funds to mobilize new financing through existing models of innovative investment programs of particular success in order to evolve the models of consumption and production ;

- To define the structural and technological changes needed to arrive by 2050 to a low carbon, resource efficient and climate resilient, enabling Europe to achieve the objectives in terms of reducing emissions and biodiversity; This means, among other things, prevent and respond to disasters, use the contribution of cohesion, agricultural, rural development and maritime to tackle climate change, in particular through adaptation measures based on a more efficient use of resources, which will also help improve global food security .

2.23 20/20/20 EUROPEAN STRATEGY

The issue of energy efficiency has become part of European policies so late compared to other topics instead since its inception as the European Community. The need to find a way common to all Member States, including with regard to the consumption and energy demand in fact arose from the need to respond in a concrete and unified directions to the Kyoto Protocol increasingly evidence of effects of global warming .

The climate and energy package has therefore been designed to achieve a number of objectives that the EU considered vital and priority: in the first proposal that the European Commission presented to Parliament and the Council in January 2008, the key points were the 20% reduction in emissions of greenhouse gas emissions compared to 1990 levels, the reduction of energy consumption by 20% compared to the levels in 2020 due to better energy efficiency and achieving a 20% share of energy from renewable sources in total consumption (Fig. 2.19).

The plan developed by the EU identified several measures to achieve these goals:

- The revision of the System EU-ETS (European Union Emission Trading Scheme), which provides for the exchange of shares of emissions of greenhouse gases. To this end, in 2013 there is an auction system for the purchase of emission allowances, the revenue from which will go to fund measures to reduce emissions and adapt to climate change.

-The system "Effort Sharing extra EU-ETS "for the breakdown of efforts to reduce emissions in sectors outside the trading scheme, such as road and sea transport or agriculture.

- The capture and geological storage of carbon dioxide: the trap is obtained from the liquid CO_2 emissions from fossil fuel power plants and other large industrial plants, which is then compressed and transported to a secure site for storage, usually consists of formations deep geological or depleted hydrocarbon reservoirs.

-The agreement on renewable energy: each Member State must increase the production of energy from renewable sources by a fixed percentage of 5.5% to which add a fee calculated on the basis of the national GDP.

-The reduction of CO_2 by car: a Regulation sets the average CO_2 emissions from new cars to 130 g CO_2/km by 2012, while by 2020 the average level of emissions for the new car fleet will be 95 gr. CO_2/km.

- The reduction of greenhouse gas emissions in the life cycle of fuels: the goal is to reduce emissions by 6%, to be achieved by the end of 2020 by using, for example, to biofuels.

Fig 2.19: Europe 20/20/20 objectives (http://www.daikinme.com/binaries/Eur-action-plan_txt_tcm582-238125.jpg)

2.24 EUROPEAN OBJECTIVES FOR 2050

Fighting climate change is now one of the main challenges of the European Union, which, after having placed the targets for 2012 and 2020, has promoted an international agreement in order to achieve the ultimate goal of cutting greenhouse gas emissions by 50 % compared to 1990 levels, by 2050.

Despite the efforts in Europe, the annual conferences of the Parties to the Convention on Climate Change of the United Nations, held in Copenhagen in 2010 (COP-15) and in Cancun in 2011 (COP-16) have not achieved the desired results, while the Durban conference in 2011 (COP-17) has collected only a commitment by participating countries to achieve by 2015 a global agreement to apply from 2020.

The European Commission, with the aim of demonstrating its commitment to the fight against climate change, it has unilaterally adopted on March 8, 2011, a roadmap that defines the key elements that should characterize the climate strategy in order to make the EU a "low carbon economy".

The ambitious challenge posed by the European Union represents a substantial reorganization of the society and in particular of key sectors such as transportation, urban planning, construction, energy production. To achieve the long-term goal of reducing emissions of greenhouse gases, the Roadmap calls for an effective and smooth transition, according to which it is necessary to reduce domestic emissions by 40% by 2030, reaching 80% in 2050. This process therefore requires a 1% annual reduction in the first decade, 1,5% in the second phase, from 2020 to 2030, and 2% in the last two decades until 2050. In these assessments, the Commission has assumed that the effort will tend to increase in the years since they will be introduced into the market new technologies and more efficient (Fig. 2.20).

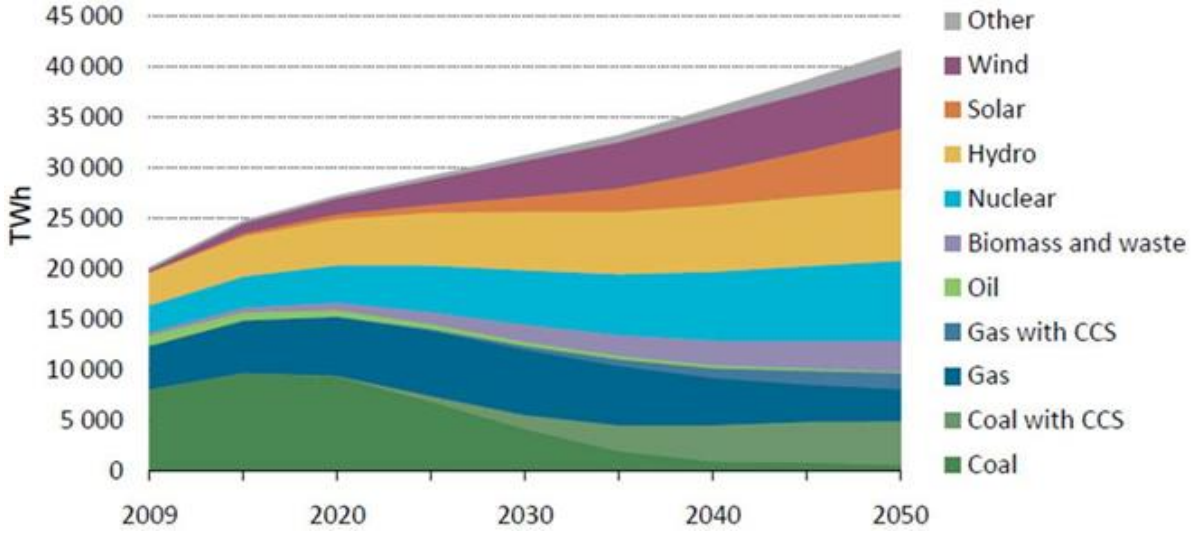

Figure 2.20: IEA prevision to 2050 (Energy Technoloy Perspectives 2012, International Energy Association)

All the sectors most responsible for the European emissions - power generation, industry, transport, construction - will have to prepare for the transition to a low carbon and resource efficient. Among these, the energy sector is the one that everyone can offer more opportunities to improve efficiency. The final energy demand expected to nearly double in 2050. Central will, therefore, developments in the production and transmission of energy, since it will also contribute to the decarbonisation of transport and heating / cooling. It is expected that in this context, there will be an increase in the use of technologies with low carbon between 45 and 60%. As a result, investment in Smart Grid will become a strong driver for an electrical system more efficient, to promote the efficiency on the demand side, the development of renewable and distributed generation and security of supply of energy.

To create a new energy system, according to the “Roadmap” drawn up by the European Commission, ten conditions must be met:

1 - The full implementation of the EU Energy 2020 strategy, by adopting the legislation on the issues of energy efficiency, infrastructure, security and international cooperation;

2 - Encourage the involvement of both sides to stimulate the energy system and the company to be more efficient;

3 - Constant attention to the degree of development, its effects on the market and the increasing of energy from renewable sources;

4 - Increase public and private investment in research and development and technological innovation;

5 - Promote the integration of national markets to create a single market for energy;

6 - Energy prices should better reflect their costs, especially those incurred for the modernization of the network;

7 - Develop new infrastructure and storage systems;

8 - The EU should take the lead in international action to halt global climate change;

9 - Develop a strategic framework for 2030 to secure the points provided for reference concrete for the member states and investors.

Pursuing these conditions, therefore, the Roadmap marked by the European Commission will achieve the targets in 2050, but at the same time strengthen Europe's competitiveness and security of supply.

2.25 THE SET-PLAN

In 2007, the European Commission has proposed a European Strategic Energy Technology Plan – SET-Plan - in order to establish an agenda for European research in the field of low-carbon technologies. The plan aims to promote industrial research and innovation, with a view to achievie the political vision of a "Europe with a sustainable economy, a world leader in clean energy technology, efficient and low-carbon [...]. A Europe that is driving the global challenge of climate change and has access to energy in developing countries" (SET-Plan, 2007).

In its communication, the Commission also stated that the achievement of ambitious goals requires close coordination between the Member States, the Community, industry and research organizations, each having a different role to play within the common effort.

The SET-Plan has four results to be achieved. The first involves a new method of governance for energy technologies, based on a joint strategic planning in order to improve consistency in the activities and to meet the competition of some industrialized countries.

Second, the SET-Plan promotes the launch of new European industrial initiatives in areas that include: wind energy, solar energy, electricity grids, bioenergy technologies for the capture and storage of carbon dioxide, nuclear fission and fuel cells and hydrogen.

The third objective set by the Commission in support of the initiatives identified by the SET-Plan is expected to increase financial resources for research, infrastructure and projects, education and training to provide new quality human resources. In this sense, financial instruments have been enhanced to support public objectives, such as the Seventh Framework Programme of the European Communities and the program "Intelligent Energy - Europe ". These programs also was accompanied by the action of the European Investment Bank who has devoted considerable resources to the development of energy technologies.

Finally, the SET-Plan lays the groundwork for a more intense international cooperation in order to promote the development, dissemination and access in the world to a low-carbon technologies. The shares will have to be addressed both to the industrialized countries, with the aim of stimulating research, but also to countries in the developing world, to provide them with new opportunities and help them to develop sustainably (Table 2.2).

Table 2.2: SET-Plan (2007)

Energy source	Technology considered	Cost (€/MWh)		GHG emissions (kg CO2 eq/MWh)	EU 27 import dependency (%)		Efficiency (%)	Fuel price sensitivity	Proven reserves
		2005	2030 (€20-30/tCO2)		2005	2030			
	Open cycle gas turbine	45-70	55-85	440	57	84	40	Very high	64 years
	Combined cycle gas turbine	35-45	40-55	400			50	Very high	
	Diesel engine	70-80	80-95	550	82	93	30	Very high	42 years
	Pulverised fuel with flue gas desulphurization	30-40	45-60	800	39	59	40-45	Medium	155 years
	Circulating fluidized bed combustion	35-45	50-65	800			40-45	Medium	
	Integrated gasification combined cycle	40-50	55-70	750			48	Medium	
	Light water reactor	40-45	40-45	15	100 (uranium ore)		33	Low	85 years
	Biomass generation plant	25-85	25-75	30	0		30-60	Nil	Renewable
	Onshore	35-110	28-80	30			95-98		
	Offshore	50-170	50-150	10			95-98		
	Large hydropwer	25-95	27-90	20			95-98		
	Small (<10MW)	45-90	40-80	5			95-98		
	Photovoltaic	140-430	55-260	100			-		

2.26 THE ENERGY INFRASTRUCTURE PRIORITIES FOR 2020

With the aim of implementing the energy strategy, the EU has also outlined a policy for infrastructure projects in the energy. EU energy goals requires in fact the support of a pan- European electricity infrastructure, able to interconnect and integrate renewable energy on a large scale.

An integrated transnational network will bring enormous benefits to consumers in terms of security of supply, stabilization of prices and services. Businesses and citizens will have access to clean energy, safe and reliable helping to maintain a strong, diversified and competitive industrial system in Europe.

Among the infrastructural challenges that require a greater commitment to be adapted to new requirements, it is certainly interesting that regarding the spread of networks "intelligent".

The Smart Grid energy networks are able to integrate efficiently in terms of cost behaviour and actions of all users connected to it (Fig. 2.21).

One of the biggest advantages introduced by the Smart Grid is the ability to simply and efficiently integrate renewable energy sources that appear to be intermittent because of their reliance on phenomena not constant, but which are an important supply of energy if properly exploited. Stakeholders from the smart grid are all utilities, ranging from simple user and producers of energy to the transmission provider and the financial community. The basic functionality of the smart grid focuses on the integration of distributed energy resources in the present system, where reference is made to DER generators, batteries and controllable loads connected to the electrical distribution system.

A fundamental feature of the smart grid isn't also the ability to manage, through protocols and information flows, active loads and generators available in the network, but coordinating them to perform certain functions in real time; for example: to cope with a peak load balance a power supply or make up for a sudden drop in voltage by drawing more and districts in which this surplus, is then applied to the grid a protocol similar to the P2P information management used in computer networks.

Several analyses also indicate that the electricity sector is the one that can offer more opportunities for reducing energy end-use, reaching a target of 9% in 2020.The development of smart grids must of course be accompanied by the introduction of energy technologies for efficient development costs towards a decarbonised way.

Fig. 2.21: EU Smart Grid (European Technology Platform Smart Grids, 2006)

PART 3: THE IMPORTANCE OF INDICATORS FOR THE SUSTAINABLE URBAN PLANNING

3.01 INTRODUCTION TO PART 3

This part defines the concept of sustainability indicator, its function and importance. Fundamental part too is the regulation and the policy of EU about this topic. It defines the principles at the base of the research of this thesis.

3.02 SUSTAINABILITY INDICATORS

The sustainability indicators are defined as such because they represent all spheres of sustainability: environment, social and economy. In addition the sustainability characterizes them from a methodological point of view as a useful tool to navigate the complexities of reality with a different perspective.

For more insight into the perspective of sustainability indicator, it is interesting to mention some of the authors who have dealt with most of IS, and whose statements also refer to what are the underlying objectives for their use : the OECD (Organization for Economic Co-operation and Development) defines the indicator as a parameter, or a value derived from parameters , which provides information on the state of a phenomenon with a meaning that goes beyond what is directly associated with the value of the parameter and must be considered as a tool that can provide the "best available knowledge " (OECD, 1993).

The World Bank states that "the key determinant of a good indicator is the link from measurement of some conditions to practical policy options" (World Bank, 1997) ; D.H. Meadows states that "indicators arise form values (we measure what we care about) and they create values (we care about what we measure) " and that "the choice of indicators is a critical determinant of the behaviour of a system" (D.H. Meadows , 1998) ; Bossel think that "indicators facilitated orientation in a complex world " (Bossell , 1999).

The use of sustainability indicators and corresponding metrics is essential for an integrated systems approach to the addressing challenges of sustainability. When carefully chosen and implemented, indicators can help managers and policy makers to (modified from Singh, *et al.*, 2008 “An overview of sustainability assessment methodologies”):

- Anticipate and assess conditions or historical trends
- Provide early warning information to prevent adverse outcomes
- Benchmark against other systems
- Communicate ideas
- Support decision-making
- Formulate strategies and establish improvement goals

• Track progress

Since the first application is in fact highlighted the need to develop models for methodological reference within which to place the different groups of IS.

Since 1990 , following the request made by the G7 Summit of 1989 , the OECD has initiated a program of work on environmental indicators, "OECD Environmental Indicators" , formulating an initial reference model , called PSR (Pressures -State- Responses) (Fig. 3.1).

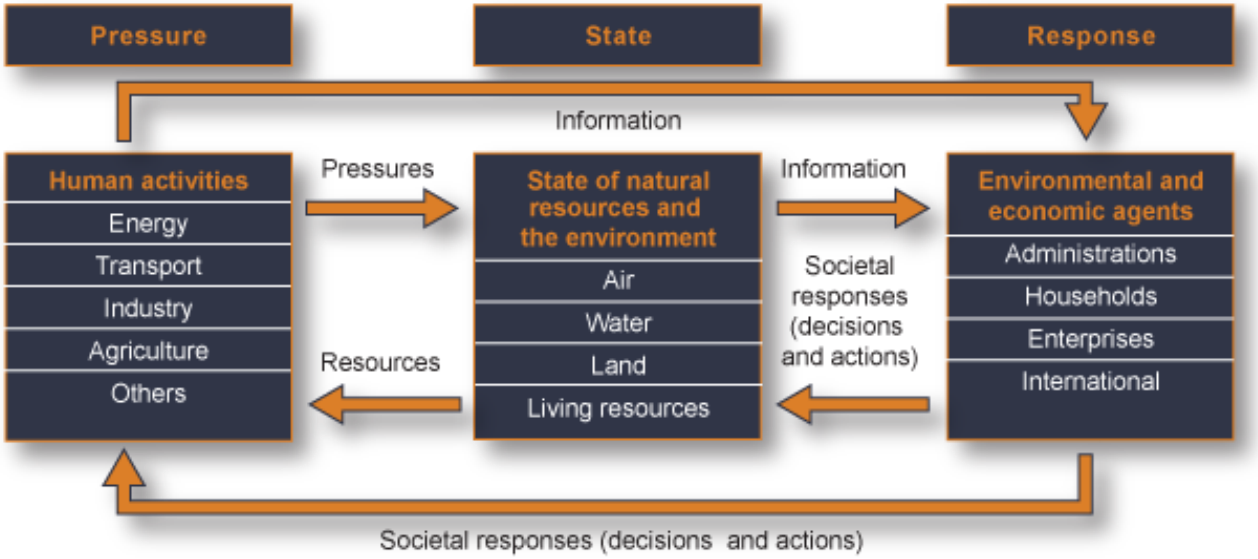

Fig 3.1: PSR functions (http://www.rscproject.org/indicators/index.php?page=what-methodologies-can-be-used-to-develop-indicator-s-or-indicator-set)

Since 1993, the PSR model has been revised by the UN - CSD (United Nations Council on Sustainable Development), which has changed DSR (Driving Forces -State- Responses), where for Driving forces are the causes generating primary or determinants (such as agriculture, industry, transport ...).

The difference between the two models is significant, because while the former does not allow any causal link, or between different groups of indicators, nor between the various dimensions of sustainability (economy, environment, society and institutions), the second focuses on the relationship between the various segments of the model, especially in view of the possible connections between the dimensions of sustainability.

In 1994 it was made operational the EEA (European Environmental Agency), which further develops the model of departure in the DPSIR (Driving Forces - Pressures State – State Impacts - Responses) , including both the category that Pressures Driving Forces , and adding the of impacts , i.e., impacts on health , ecosystems and the economy. This model is currently the most widely used by government and non-governmental organizations that deal with sustainability.

3.03 WHAT ARE THE INDICATORS OF SUSTAINABILITY?

The indicators are a measurement tool that, through a certain unit of measurement, can be used to provide data to record positive or negative changes, to make comparisons of performance to support the decisions of policy-makers to focus the commitment of the public, to involve the citizens, to raise awareness on the issues they deal with. In particular may be useful to:

• Measure of the changes (positive or negative);

• predict the changes (for example, the increase in unemployment will result in a lowering of housing prices in the future);

• confirm the changes (for example, the high prices of the houses confirm a high level of employment).

The IS, in particular, are born with the aim to develop sustainability assessments, that is, to measure the progress of sustainable development in a specific context.

The main purpose of the projects of sustainable development indicators is to clarify the attendance of environmental events giving an objective opinion in deep contrast with the current behaviour, to let public opinion understand the real risk of it, instead of fomenting the compulsive emergency view given to people and to fix certain objectives that must be reached for the real sustainable development. The project must be designed to be easy to read and to understand by dividing indicators and targets into groups.

Over the years the debate on sustainability has greatly influenced the work on the IS, broadening the perspective from the environmental, social institutional and economic aspects and affecting all four dimensions of sustainability. In this sense, the work has been devoted to the development of indices able to “measure " the quality of life, not just on the basis of economic wealth and then to the GDP, but also on other aspects that sustainability has led the centre of attention .

The theme of sustainability, as said before, involves every sector of human life and it is therefore useful to rethink the tools with which usually measures the level of well-being, reviewing the concept of quality of life in a sustainable way.

At the same time it has made its way more and more the idea that progress towards sustainable development cannot be determined without focusing specifically on the question of the city. However, the main Core Set of IS developed to apply on a national or regional focus with particular attention on policies for large areas.

Generally there are two types of evaluations of sustainability : one that monitors environmental systems (of a city, a region or a state) , the components of the environment (air, water, soil , ...) or , more generally , the situation in terms of sustainability (not just environmental) of a given territory; the second the development policies in a sustainable (urban policy , transport , economic, tourist, cultural , ...).

With the first applications tended to use large lists of indicators, in order to make an analysis as possible rich and detailed. Soon, however, showed the difficulty to manage, develop and update an excessive amount of data, and were proceeded to the simplification of large lists, thermalizing and reducing the number of indicators in the Core Set, could be capable of measuring micro-changes in short periods of time.

With regard to the monitoring of the state of sustainability of a certain geographical area (mainly at national level), have been developed the synthetic indicators (indices), that aggregates several data, provide a single number in the requested information; compared to a macro – level, the different territories, among them the ecological Footprint (which is certainly the most well-known) , the Space Environment, the Environmental Sustainability Index (ESI) , the Environmental Performance Index (EPI) , the European Green Cities Index and the Genuine Savings of the World Bank , are characterized by the ecological approach that makes use of the territory to report the load capacity ecosystems (carrying capacity).

Certainly a reliable assessment requires particular attention to the phase of population indicators; in addition to a clearly defined conceptual framework, it is crucial that it is a structured way of working which references to the information structures of reference: each indicator must always be accompanied from a methodological card, containing the detailed information regarding the methods of detection and treatment of the data (source, method of calculation, timing , reference databases , ...).

3.04 THE CORE SET OF INDICATORS

The OECD[1] has launched, in the early ‘90s, a research program on environmental indicators, developing a core set based on PSR model (Pressures - State - Response) presented in the document, published in 1993, OECD Core Set of indicators for Environmental Performance Reviews.

The document is the work of a group of experts and the collaboration with the member countries, which, after several adjustments, proposed a set of indicators related to environmental issues.

The PSR model used by the OECD considers the relationship between man and environment in the light of three categories of reference , linked by causal relations : human activities exert pressures on the environment by altering the quality and quantity of resources, the actions taken by policy-makers must form responses can reduce or eliminate the problems identified (Fig. 3.2).

Within the document, indicators are grouped by themes and within each theme are listed indicators of pressure, state and response:

• Pressure indicators: they represent the pressure exerted on the environment by human activities, both in the form of subtraction of resources in the form of emission of residues , and can be divided into

[1] Organisation for Economic Co-operation and Development

direct indicators , which measure directly impacts exercised on the environment , as emissions of carbon dioxide, and indirect indicators related to human activities that affect the direct indicators ;

• Status indicators: they refer to the quality of the environment and the quality and quantity of natural resources and allow you to arrive at a comprehensive understanding of the conditions of the environment and its changes over time;

• Response indicators: they are the indicators that can measure how the company is responding to changes and environmental concerns; answers relate to both individual and collective actions designed to mitigate or prevent adverse impacts on the environment caused by human actions and to stop the damage already produced.

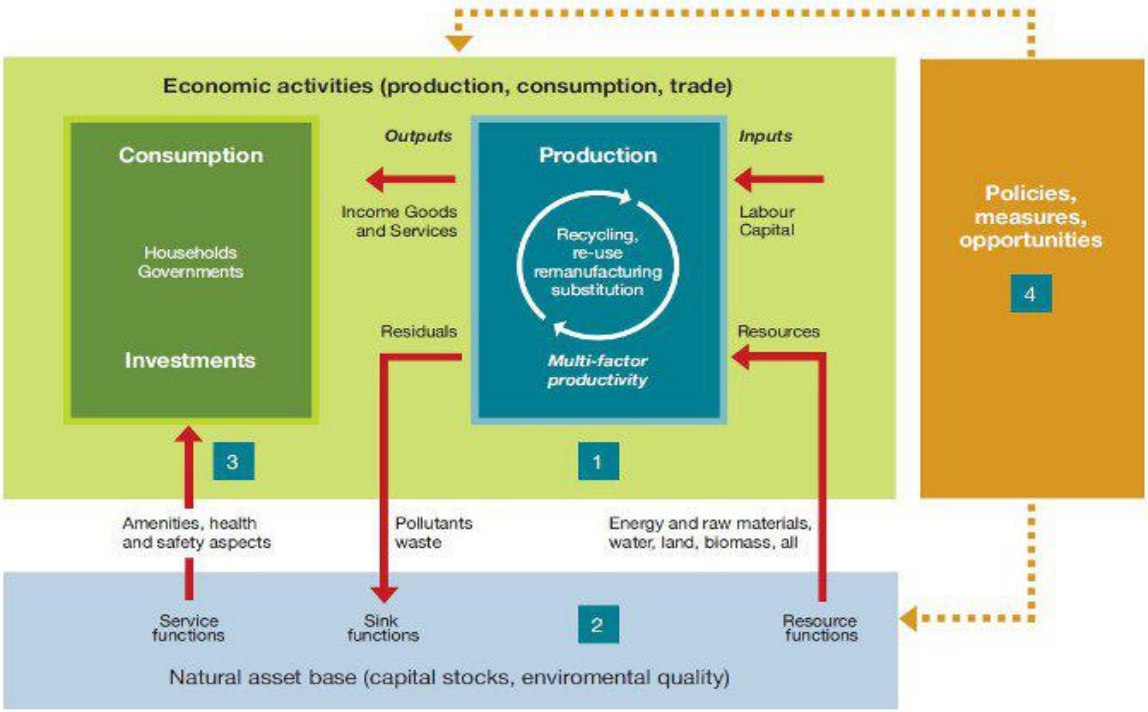

Fig 3.2: OECD measurement frameworks (http://www.oecd.org/greengrowth/greengrowthindicators.htm)

The UNCHS[2] has dedicated time to the problems related to human settlements and, following the Conference in Rio de Janeiro in 1992, has expanded its field of investigation and also concerns about the problems of the city.

This agency has launched in 1989 an international, program for the urban indicators, which involved the major cities of 104 countries, reaching to the definition of its own set of indicators.

The core set indicators was presented in 1997 within the text Monitoring Human Settlements with Urban Indicators; indicators are divided according to the key issues relating to the various sectors of the Habitat Agenda - socio-economic development, infrastructure, transport, environmental management, local government, and housing - in addition to other general aspects such as economics and demographics.

The text also divides the indicators into two groups:

• Key indicators: these 40 indicators that make up the city proper set of indicators proposed to the countries concerned;

• Extensive indicators: 124 urban indicators of lesser importance and more difficult measurability.

The work of the CSD[3] in relation to indicators of sustainability is one of the most complete and systematic that has been made in this field. Responding to the call made at the Rio Conference in 1992 through Chapter 40 of Agenda 21, the Commission has begun to deal with sustainability indicators, in order to make accessible indicators to policy makers at the national level.

In 1995 it adopted a program of work on this issue, which led to the publication, in 1996, a first report on indicators, which involved a group of 45 experts and specialists from around 100 to important national and international agencies. One of the most significant elements of this first phase of the work was the development of the methodology sheets that, for each indicator, were to describe the policy relevance, the methodology used for the measurement and data availability.

The publication of the first report was immediately followed by a phase of experimentation, which has involved 22 countries and lasted about two years, whose main purpose was to identify the existing priorities at the national level and relate them to the process of identification and selection of indicators. The trial has led to a revision of the first report, merged in 2001, a new version of the same, Indicators of Sustainable Development Framework and Methodologies.

The system of indicators proposed by CSD follows the guidelines of Agenda 21 and it’s articulated in four areas: social, environmental, economic and institutional. Are thus identified 57 indicators, which

[2] United Nations Centre for Human Settlements
[3] Commission on Sustainable Development

offers both the CSD to the States and the regions. Although the system is designed for the national level, most of the indicators can also be used at the local level.

The Expert Group on the Urban Environment Directorate General of the European Commission has presented its own set of indicators within the text: "Towards a framework of sustainability at the local level - European Common Indicators" (2000).

This document is the result of an initiative - European Common Indicators - initiated by the European Commission in 1999 in collaboration with the EAE, which has also seen the active participation of local authorities, is engaged in the provision of informative, used to check the status of information at local level, both in the verification of the proposals of the expert group.

Following a first phase of analysis, there were identified 18 common European indicators, the number of which, on the basis of consultation with the local authorities involved, was later increased to 20. A second phase, which culminated with the holding of the first workshop technician of European Common Indicators, which took place in the city of Seville in 2000, led to the identification of a group of 10 European common indicators. These were divided into 5 indicators mandatory and 5 optional indicators.

Indicators Required:

• A1 - citizens' satisfaction with reference to the Local Community = level of citizen satisfaction;

• A2 - Local contribution to global climate change = CO_2 equivalent emissions;

• A3 - Local mobility and passenger transport = number of daily trips and time spent per capita by reason and by mode of transport used , the total distance travelled daily average per capita by type of movement and mode of transport;

• A4 - accessibility of public green areas and local services = accessibility of citizens to public open areas and other basic services;

• A5 - local air quality = number of exceedances of the limit values for certain pollutants, the level of implementation of the Plan of Rehabilitation / air quality management.

Optional indicators:

• B6 - moving house - school children = mode of transport used by pupils to travel by home to school and vice versa;

• B7 - the sustainable management of the local authority and local businesses = percentage of public and private organizations that adopt and use a form of social and environmental management;

• B8 - noise = proportion of the population exposed to high levels of ambient noise in the long run , the noise levels in well-defined areas to " internal common existence and level of implementation of the Restructuring Plan noise ;

• B9 - sustainable land use:

A) Urbanized or artificially surfaces: artificial surface as a percentage of the total administrative area;

B) abandoned land: extent of derelict land and contaminated soil;

C) Intensity of use: number of inhabitants per km^2 land area classified as urban;

D) New development: quota of new building on virgin land and derelict and contaminated land;

E) Restoration of urban land recovery and conversion of derelict buildings, rehabilitation of derelict land for new urban uses including public green areas, remediation of contaminated soils;

F) protected areas as a percentage of the total area under the jurisdiction of the local administration;

• B10 - sustainable products = share, on total consumption of sustainable products.

The indicators were in turn further subdivided; they have been developed for each of the methodology sheets for use in the identification phase and data collection, which was followed by an experimental phase of the indicators from the local authorities involved.

The ultimate purpose of the definition of indicators for the urban environment, is to let the indicators themselves both in the decision-making policies affecting cities, both in the monitoring and evaluation of the implementation of programs, plans and individual decisions concerning the urban territory. In summary, the systematic use of common indicators accepted and should be producing better decisions for the urban environment.

The indicators for the urban environment, therefore, have value only on three conditions:

1. Whether they are technically correct, that is, whether allow to get the best decisions for the environment or if the environment once transformed and complies with the quantitative thresholds specified by the indicators, it appears , made use of that room by the municipality citizen , actually an urban environment better environmentally to live and work ;

2. Whether they are compatible with the system of the information available in an ordinary way (without making unrealistic additional investment of money and time) on the part of policy makers;

3. They can be used in making decisions regarding the territory in accordance with the timing of the planning, which has been and remains the discipline appointed to regulate the transformation of the city and its territory, namely the discipline from the exercise of which derive the greatest effects on the permanent urban environment.

In 2014 the OCED published a new list of indicators that is divided in 12 categories with 31 core indicators and 106 extensive indicators.

3.05 LEED RANKING SYSTEM

The instrument LEED for Neighbourhoods Development in 2009 has been developed by US Congress for the New Urbanism and aims to reduce the amount of soil exponentially due sprawl of American cities. It wants to create a pattern of city design that affect human behaviours that have a significant effect on the environmental performance, to avoid the development linear currently characterizes the city, because of pollution and neglect of development of the traditional city mixed-use development.

It is designed to certify exemplary development projects that get good results in terms of smart growth, urban planning and construction. The instrument is mainly used for the certification of new sustainable districts, but also the redevelopment of brownfield sites, or of existing neighbourhoods for their rent or sale.

LEED is a voluntary and consensus-based system, for the design, construction, operation of sustainable buildings, land areas and high performance that is developing more and more at the international level; can be used on any type of building and promotes a system of integrated design that covers the entire building (Fig. 3.3).

Fig 3.3: LEED categories (http://www.usgbc.org/LEED#rating)

Each indicator must be assigned a score in the range, which is assigned based on the importance of each criteria with a total score 106 points.

The certification is a third party verification, independent of the performance of an entire building (or part of it) and / or urban areas. LEED certification, recognized internationally, says that a building is environmentally friendly and is a healthy place to live and work.

Obtaining LEED certification allows for both economic and environmental benefits, including:

- Establish a common standard of measurement of "green buildings", defined as buildings with low environmental impact;
- Provide and promote an integrated design that covers the entire building;
- Give recognition to those who create virtuous performance in the construction field;
- Stimulate competition on the theme of environmental performance;
- Establishing a market value with the creation of a brand recognized worldwide;
- Helping clients and increase their awareness of the importance of building green;
- Transform the market and the construction sector.
- The reduction in operating costs, increasing the value of the property.
- The reduction of waste sent to landfills.
- The energy and water saving.
- The development of healthier buildings and safer for the occupants.
- Creating compact communities and accessible with good access to neighbourhood services and transit
- The protection of natural and agricultural resources, encouraging urban development in areas already populated.
- The reduction of harmful emissions of greenhouse gases.
- The opportunity to take advantage of tax breaks, subsidies, zoning, and other incentives in hundreds of cities.
- The demonstration of the commitment of the owner to environmental stewardship and social responsibility.

The LEED-ND offers an array of 102 indicators, divided into five categories (Fig. 3.4):

1. Smart Location and Linkage;

2. Pattern and design of the neighbourhood;

3. Green Infrastructure and Buildings;

4. The process of innovation and design;

5. Regional Priorities

Fig 3.4: LEED-ND indicators rank (http://www.usgbc.org/LEED#rating)

3.06 THE PORTUGUESE SYSTEM "LIDERA"

LIDERA is a system developed in Portugal in 2000 by Professor Manuel Duarte Pinheiro of the Department of Civil Engineering and Architecture of the Instituto Superior Tecnico of Lisbon. The purpose is to evaluate the sustainable construction and the built environment, developed for Portugal and the Portuguese-speaking countries.

The system aims to support the development of plans and projects that seek sustainability: it assess the level of sustainability in the various phases of the construction (design, working and functioning); it supports the management in construction and operation and ensures it through an independent evaluation.

The first version V1.02 of the system, in 2005, was addressed only to existing buildings and the surrounding environment. The new version V2.0 has allowed the extension of the distribution system for the built environment, open spaces, blocks, neighbourhoods and sustainable communities.

LIDERA is divided into 22 areas, 43 indicators and 6 basic principles:

• Principle 1 - Improving the local dynamics and promoting proper integration;

• Principle 2 - Promote the efficient use of resources;

• Principle 3 - Reduce the impact of loads (both in value and toxicity);

• Principle 4 - Ensuring the quality of the environment, focusing on environmental comfort;

• Principle 5 - promoting experiences socio-economic development;

• Principle 6 - To ensure the best use of sustainable built environments through environmental management and innovation.

Fig 3.5: LIDERA system (Lidera 2009)

The areas of evaluation of the system are:

• Local integration, as regards the soil, natural ecosystems and landscape and heritage;

• Resources, including energy, water, materials and food production;

• Environmental burdens, involving effluents, air emissions, waste, noise, pollution and outside lights-heat;

• Comfort in environmental air quality, thermal comfort and lighting and acoustics;

• The socio-economic experience, which includes Access for All, economic diversity, structures and social interaction, participation and control, and the cost of the life cycle;

• Sustainable use, part of environmental management and innovation.

The system classifies the performance of a G to A (up +++), while the level E is the current practice (or reference) and the level A corresponds in many features, superior performance by about 50% compared to the level E , with the level to + a factor of 4 (75% and higher than the level), the level ++ a factor of 10 (90% and higher than the level), and reserves for the future the possibility of a +++ existing level, which is a regenerative state.

3.07 THE IUSIL SYSTEM

In 2010 a researching partnership between the Hong Kong Polytechnic University and the Indian National Institute of Construction Management, creates and definite a system of sustainable indicator with the name of IUSIL: International Urban Sustainability Indicator List (Table 3.1).

"The purpose is to have a comprehensive list as a comparative base. IUSIL includes a wide variety of indicators that determine the urban sustainability performance of a city and they are used to examine the variations between individual practices. IUSIL contains 115 indicators, formed into 37 categories in order to better structure the indicators within 4 sustainable development dimensions: environmental, economic, social and governance" (Li-Yin Shen, et al., 2011).

Table 3.1: IUSIL indicators

DIMENSION	CODE	CATEGORY	N of indicators
Environmental	En 1	Geographically balanced settlement	2
	En 2	Freshwater	4
	En 3	Wastewater	2
	En 4	Quality of ambient air and atmosphere	4
	En 5	Noise pollution	3
	En 6	Sustainable land use	9
	En 7	Waste generation and management	6
	En 8	Effective and environmentally sound transportation systems	3
	En 9	Mechanisms to prepare and implement environmental plans	2
	En 10	Biodiversity	7
Economic	Ec1	Consumption and production patterns	6
	Ec2	Economic development	5
	Ec3	Finance	4
	Ec4	Water	2
	Ec5	Strengthen small and microenterprises	1
Social	So1	Energy Access	3
	So2	Water Access	2
	So3	Education	3
	So4	Health	4
	So5	Safety	3
	So6	Fire & Emergency Response	3
	So7	Poverty	2
	So8	Transportation	8
	So9	Natural hazards	3
	So10	Adequate housing	4
	So11	Shelter	2
	So12	Security of tenure	3
	So13	Access to credit	1
	So14	Access to land	1
	So15	Promote social integration and support disadvantaged groups	1
	So16	Culture	2
	So17	Recreation	2
	So18	Availability of local public green areas and local services	1
Governance	Go1	Participation and civic engagement	3
	Go2	Transparent, accountable and efficient governance	1
	Go3	Government	2
	Go4	Sustainable management of the authorities and businesses	1

The system were used for stress 29 urban development plans but only 9 contain sufficient information for the analysis.

The result of the study evidence that there is not uniformity between the different plans, each city works for itself using different guidelines from international organizations.

3.08 THE STAR COMMUNITY RATING SYSTEM

The Sustainability Tools for Assessing and Rating communities (STAR) is a system released on October 2012, based on 7 goal areas with 44 indicators.

The main objectives of the STAR are:

- Built Environment: Achieve liveability, choice, and access for all where people live, work, and play
- Climate & Energy: Reduce climate impacts through adaptation and mitigation efforts and increase resource efficiency
- Economy & Jobs: Create equitably shared prosperity and access to quality jobs
- Education, Arts & Community: Empower vibrant, educated, connected, and diverse communities
- Equity & Empowerment: Ensure equity, inclusion, and access to opportunity for all citizens
- Health & Safety: Strengthen communities to be healthy, resilient and safe places for residents and businesses
- Natural Systems: Protect and restore the natural resource base upon which life depends

The rating system is based on 4 different levels:

Table 3.2: Star Certification System (STAR 2014)

Certification Rating Levels	Point Range
5-STAR Community Recognized as a top tier in national sustainability	600+
4-STAR Community Recognized for sustainability leadership	400-599
3-STAR Community Recognized for sustainability leadership	200-399
Reporting STAR Community Currently pursuing certification	<200

The STAR Community Rating System is built by and for local governments and the communities for the evaluation of U.S. cities, towns and countries.

3.09 THE GLOBAL CITY INDICATORS: ISO 37120:2014

On 15 May of 2014, the World Council on City Data (WCCD) published an indicator system for the standardization of city evaluation: the ISO 37120:2014 -Sustainable Development of Communities: Indicators for City Services and Quality of Life.

The main reason of the creation of this system was that every city or country used and collected data independently, there were not standardization and definition on what and how to measure and no sharing of knowledge between different realties.

The development involved 20 different countries and 6 international meetings for produce the first edition of the system.

It is based on 17 main themes with 100 indicators (46 Core, 54 Supporting) with standardized definition and methodology. The ranking system is based on a 3 scale levels (green, yellow and red).

The objectives of the system are:

- Manage and make informed decisions through data analysis
- Benchmark and target
- Plan and establish new frameworks for sustainable planning
- Leverage funding with senior levels of government
- Evaluate the “impact” of infrastructure projects on the overall performance of a city
- Build creditworthiness and insurance security
- Build smart and Sustainable Cities
- Learn and share lessons across other cities globally

3.10 BENCHMARKING OF THE SYSTEMS

The systems previously described were developed with different purpose and targets. The main reason of the sustainable urban planning is to provide and improve better quality of life in the cities.

The first aspect to analyse is the main objective of a system, the second one is when it was made, the third is for which market was made and the last one is the evaluation system (Table 3.4).

Table 3.4: Benchmarking of systems

NAME	OBJECTIVE	DATE	EVALUATION CRITERIA	USE
OECD	Enviromental Performance Reviews	Early '90	3 Categories 13 Indicators	Worldwide
UNCHS	Monitoring Human Settlements with Urban Indicators	1997	40 Key indicators 124 Extensive indicators	Worldwide
EU	Sustainability at local level	2000	5 Mandatory Indicators 5 Optional Indicators	EU
CSD	Indicators of Sustainable Development	2001	57 Indicators	Worldwide
LEED-ND	New Urbanism Contrast Sprawl US	2009	5 Categories 102 Indicators	Worldwide
LIDERA	Sustainable Construction Build Environment	2009	22 Categories 43 Indicators	Portugal and Portuguese speaking countries
IUSIL	Standardization of Sustaintable Indicators	2010	4 Dimension 37 Categories 115 Indicators	Not Used
STAR	Sustainability at local level	2012	7 Goals 44 Indicators	US
OECD	Economic, social & enviromental statistics	2014	12 Categories 31 Core indicators 106 Extensive Indicators	Worldwide
ISO 37120:2014	Standardization of Sustaintable Indicators	2014	17 Categories 100 Indicators	Worldwide

From this analysis, the success of an indicators system is determinate by the variety of indicators and categories, the level of applicability and actuality.

A simple interface for use in the joint with objectivity and availability of data may make the system more competitive in the international panorama.

3.11 WORLDWIDE PRACTICES WITH INDICATORS

In the last years the use indicators in the urban planning system took a fundamental role in the project phase. Thanks to a knowledge and culture more developed in the field of sustainability, a lot of cities tried to solve their environmental, social and economic problems with the use of a smart approach.

3.11.1 SINGAPORE

Singapore is a city-state that is spread over different islands. The increasing economic development and population has created many problems to the city government. One of the biggest has been managing the water resources that, first divided into several entities, was merged into a single in 1963. This action allowed to develop the project "NEWater" consisting in the collection and treatment of drinking water. The target is to reach 50% of water resources for the city in 2060, currently is at 30%.

In addition, the Singapore government through the "Our Home, Our Environment, Our Future: Sustainable Singapore Blueprint 2015" has set targets for 2030 with 18 different indicators (ANNEX).

3.11.2 OEIRAS E-CITY

The project Oeiras E-City (Amado, *et al*., 2014) is a partnership between the city of Oeiras and GEOTPU (Research Group of Spatial and Urban Planning of FCT UNL) headed by Professor Miguel Amado. The theme of the research was the reinforcement of energy efficiency in the city, through the development of a technology platform for monitoring energy flows.

The system consists of different interactive maps, each for every indicator examined, which connected to a suitable monitoring system, allows the study and development of urban planning in the energy field.

The indicators taken into consideration are the following (Table 3.5):

Table 3.5: E-City indicators

Category	Indicators
Consumption	Electricity
	Natural Gas
	CO2 Emissions
Costs	Electricity
	Natural Gas
Production	Annual Solar Potencial
	Expected Productivity
Balance	Energetic Balance

3.11.3 COPENHAGEN

Copenhagen is considered the world's most sustainable city; low emissions of air pollution, high living comfort and cities suitable for men are some of the cornerstones of the Danish environmental policy.

The design since 2009 has always been focused in 14 categories: land-use, transport, energy, water supply, handling recycling of materials, green and blue areas, social diversity, the urban space, urban life, identity, commerce and service, municipal economy, project economy and durability.

The main goal that the city has set by 2025 is to become a carbon neutral city. That means a reduction of 39% CO_2 emission since 2012 with this principles:

• The transformation takes place gradually over a long time period.

• Sound financial initiatives are set in motion as soon as possible.

• The shift to green transport, which is relatively expensive, starts with development projects in most cases.

• As well as reducing carbon emissions, initiatives should also, if possible, create green growth and enhance the quality of life.

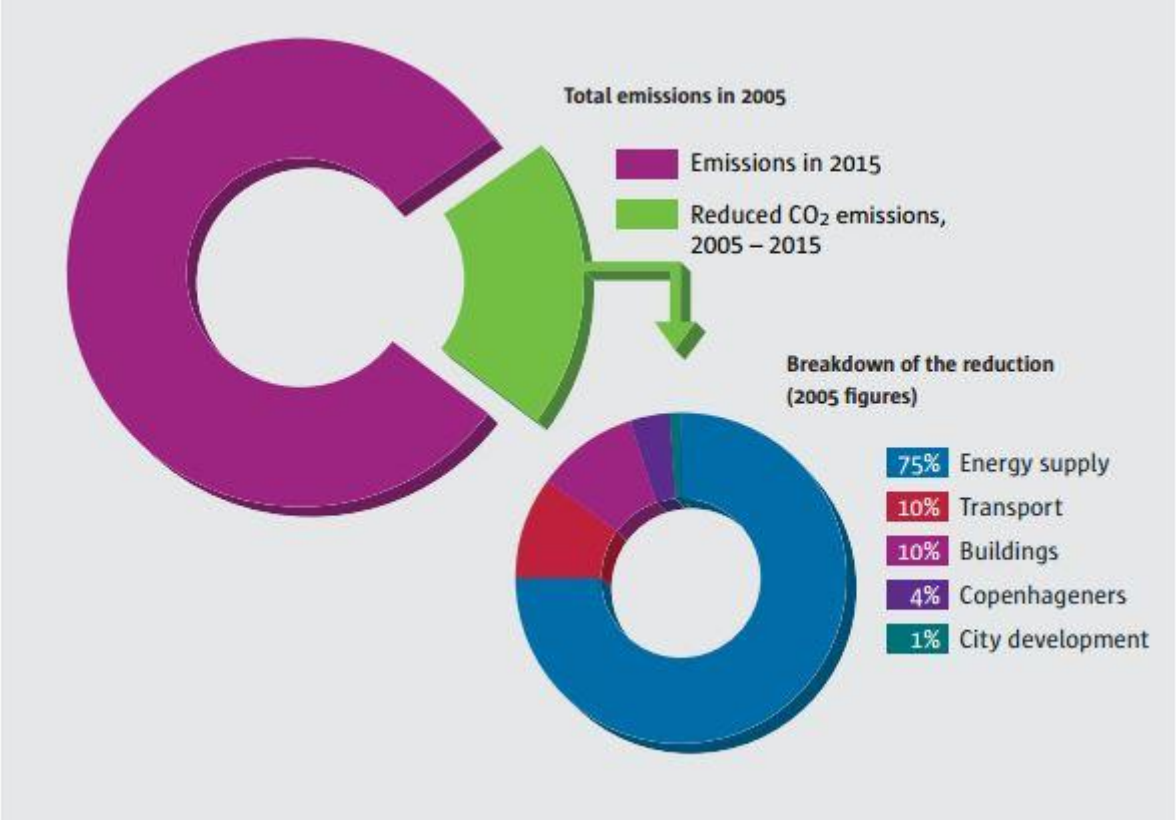

Fig 3.6: Distribution of the total co2 reduction, 2005 – 2015 (https://stateofgreen.com/files/download/411)

3.11.4 MEXICO CITY

Mexico City in 1992 was considered the most polluted city in the world. The city government through the Plano Verde (2007), lasting 15 years, decided to transform the city in a smart and environmentally sustainable model for Latin America.

The categories used in the project are:

- Land conservation
- Liveability and public space
- Water supply
- Transportation and mobility
- Air pollution
- Waste and recycling
- Energy and climate action.

With a policy directed to the use of alternative and sustainable transport, the gradual reforestation of some areas and the intelligent management let Mexico City to complete its goals and become a eco-friendly city model in Latin America.

3.12 CONCLUSIONS

The system of indicators in some cities has been critical to the achievement of objectives. A time schedule and the choice of the right criteria is the basis of urban planning of the future.

The importance of a method of universal assessment is required to develop a balanced system for any scenario.

PART 4: SYSTEM OF SUSTAINABLE URBAN PLANNING

4.01 INTRODUCTION TO PART 4

The fourth part presented a proposal for a rating system, called "SSUP"(System of Sustainable Urban Planning), with the application in the field of sustainable urban planning. It evaluates the efficiency of the city or portions of it, contributing to an objective analysis and practice, to obtain a high level in the field of sustainability by means of the components of the system policies.

4.02 THE NEED FOR A SYSTEM OF SUSTAINABLE URBAN PLANNING

The increasing amount of world population, air pollution, consumption of soil and natural resources are pushing the international community to think about a more intelligent approach on the structure and management of cities.

Until the last decade, to the causes of the improved economic situation and theories based on the unilateral consumption of resources, urban planning was based on outdated concepts mainly based on the conception of the Fordist society.

"And then, the time of urban development are not dictated solely by economic component, which since the 60s is the process and that, with the use of new planning processes, is framed for measures to promote the principles of sustainable development. (...) As at the beginning of the industrial revolution, the mechanization of the production system to improve working conditions and productivity, so now the new urban planning process must ensure improvement in the quality effectively of people's lives. "(Amado, 2005).

Many international entities (ICLEI, EU, UN ...) and sovereign governments have created systems of sustainable urban planning type. The main problem is that there is no uniformity of systems within the different countries.

An interesting example is the Green City Index of Siemens (2009), which uses 30 indicators to assess and monitor 40 different cities in Europe but which is focused only on environmental aspect.

For this there is the need to create a system of urban planning that allows sustainability in different fields such as in the social, cultural and integration.

4.03 GUIDELINE OF THE SUGGESTION

Starting from existent systems of evaluation a group of indicators was created. Those group lead the path to the design or study of the energetic and urban sustainability of cities. All the indicators chosen give the possibility to plan a modern city in respect of nature, independent and with high quality of life and socially active toward its citizens. To achieve the construction of this model, the study was based on the European policy*:*

1. Incentive of energy savings
2. Use of renewable energy sources
3. Limitation of the consumption of natural resources
4. Protection of citizens health
5. Sociability and equal accessibility without discrimination

Keeping in mind the main factor of this study "Energetic sustainability" a series of indicators were chosen following some criteria. In particular there were selected ones that could give a significant improvement to the quality of city and economically affordable.

- Importance: indicators should be representative and describe the several significant aspects of sustainability;
- Uniqueness: only the one representing different aspects of sustainability will be introduced in the matrix;
- Predictability: there is a very wide number of indicators for the evaluation, but since the goal is to guide the planning, the study is focused in consider only the indexes that are really able to predict the impacts of the proposed actions;
- Viability: an indicator could be measured under an economical aspect;
- Availability: information and data considered are from different kind of studies giving more strength to the creation of the matrix;

4.04 BASED CONCEPTS

With the changing of times and priorities in human life, a sustainable urbanization planning must be developed taking in account the importance of the environment, its resources and men's possibility. In a stage of stagnancy of economies and the difficulty of creating new job places, a model of city capable to limit the energy consumption and to produce a part of the daily amount of food for its citizens was developed.

The new planning has to fulfill some basic aspects of the urbanization as described by M. Amado (2002):

- The improving of life and work conditions of the population in respect of the cultural, environmental and landscaping values
- The balanced distribution of housing, work, culture and leisure
- The creation of different working opportunities for undeveloped areas
- The adaptation of the level of urban density, preventing the degradation of the quality of life as well the misbalance of the economic and social organization
- The rationalization of the infrastructures preventing the useless extension of urban network and urban perimeter with the using of existing one.

- The conservation of the environment.

Following those principles the idea of a new method raised up implementing them with:

- The energy independence and the possibility of recycling
- The limitation of the pollution by vehicles
- A solid assistance to unemployment with the creation of work for the community
- Innovative constructions, eco-friendly and 0 impact.

With these principles as the method of research have been identified indicators considered essential in the creation of this project. As stated earlier in some of these indicators are, according to the European directive, essential for sustainability.

4.05 METHODOLOGY OF THE PURPOSE SYSTEM

The sustainable urban planning must contain in addition to the environmental concept also social, urban and economic factors that have the goal of developing and / or transforming the territory.

To implement this purpose it is necessary to create a system of indicators able to meet the categories listed above. Once set up and calibrated, the system proceeds to the first step that consists in the simulation of use over a territory. If this simulation is incomplete proceed with a reformulation of the indicator system, while if it is satisfactory and comprehensive proceed to its implementation on the ground.

The next step is the monitoring of the development and / or transformation of the region through the same indicators to check that the proposed objectives are met.

A constant monitoring and updating data in the system is fundamental to the success of the operation of sustainable urban planning (Fig. 4.1).

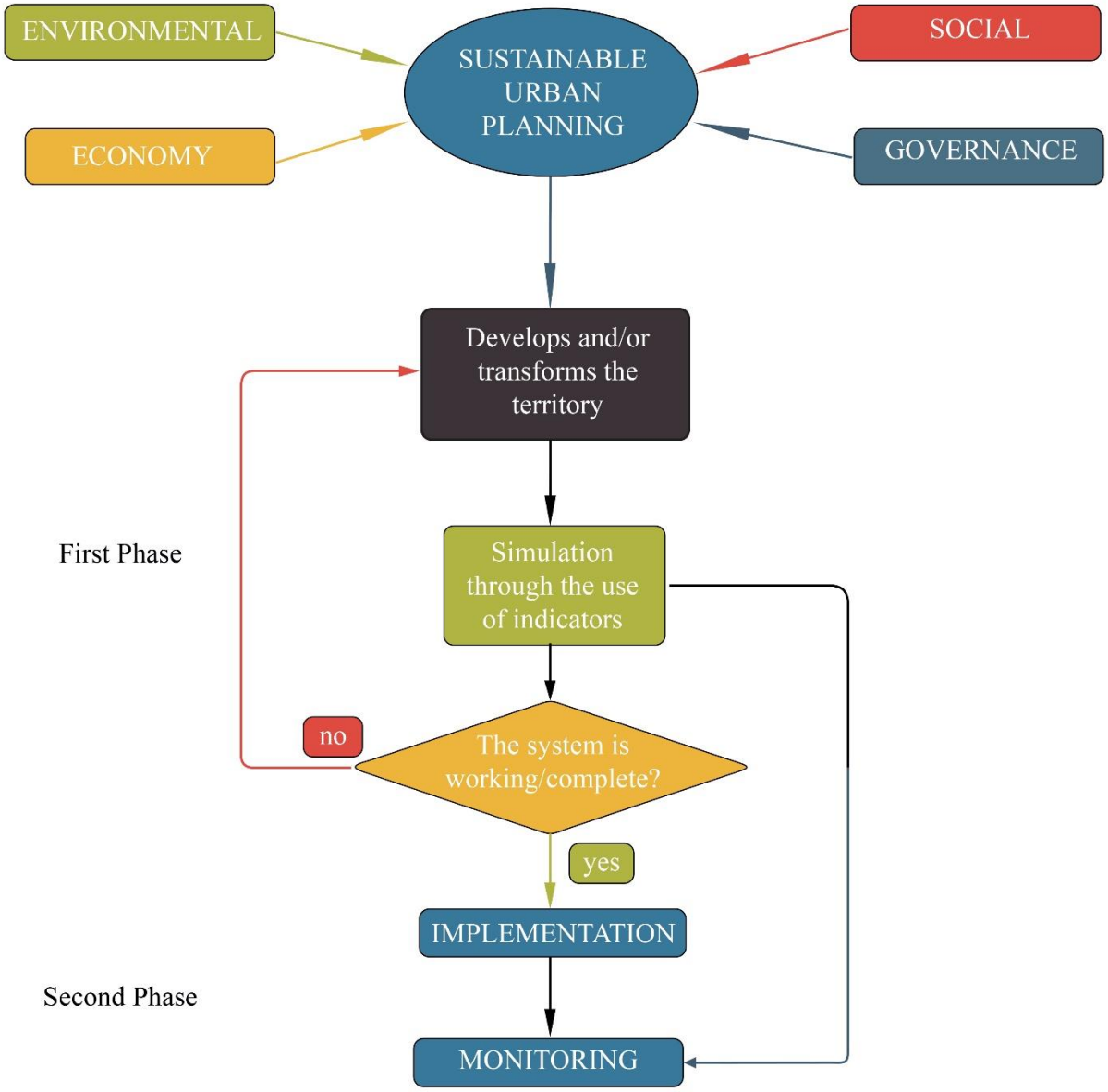

Fig. 4.1 Methodological scheme of the system

4.06 SYSTEM OPERATION

The “SSUP” (System of Sustainable Urban Planning) uses a computer program (Excel), in which, interconnecting various data with the study on the basis of 4 Macro areas, it generates a result.

The weight distribution of the system is made according to each sector, factor, area, parameters and evaluation criteria; the points are assigned based on the degree of importance attached to the principles of sustainability.

In this sense, one of the 4 Macro Area (Fig. 4.2) of sustainable urban planning is attributed to the higher weight: the environmental aspect (45%). This percentage shows the great importance given to environmental problems arising from the process of resource exploitation in the global context.

The weight given to the social aspect (30 %) comes from a set of indicators that describe the livability of a specific area.

The category reserved for economy (15%) contains all the utility that an aggregate urban should have for their own self-sustainability.

The last category is governance (10%) and analyzed all the aspect about the government in a specific area

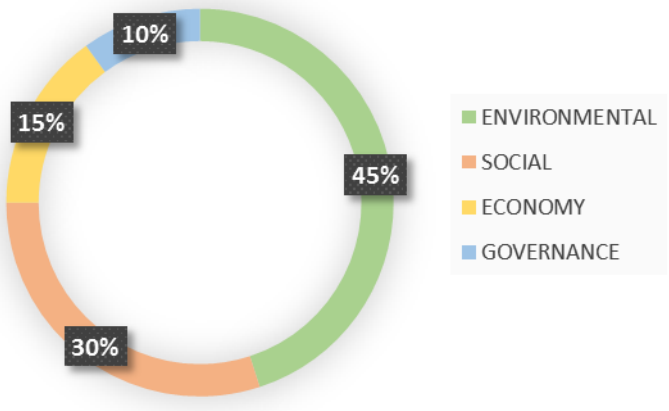

Fig 4.2: Macro Area Ponderation

The Sections contained in the Macro Areas are 8:

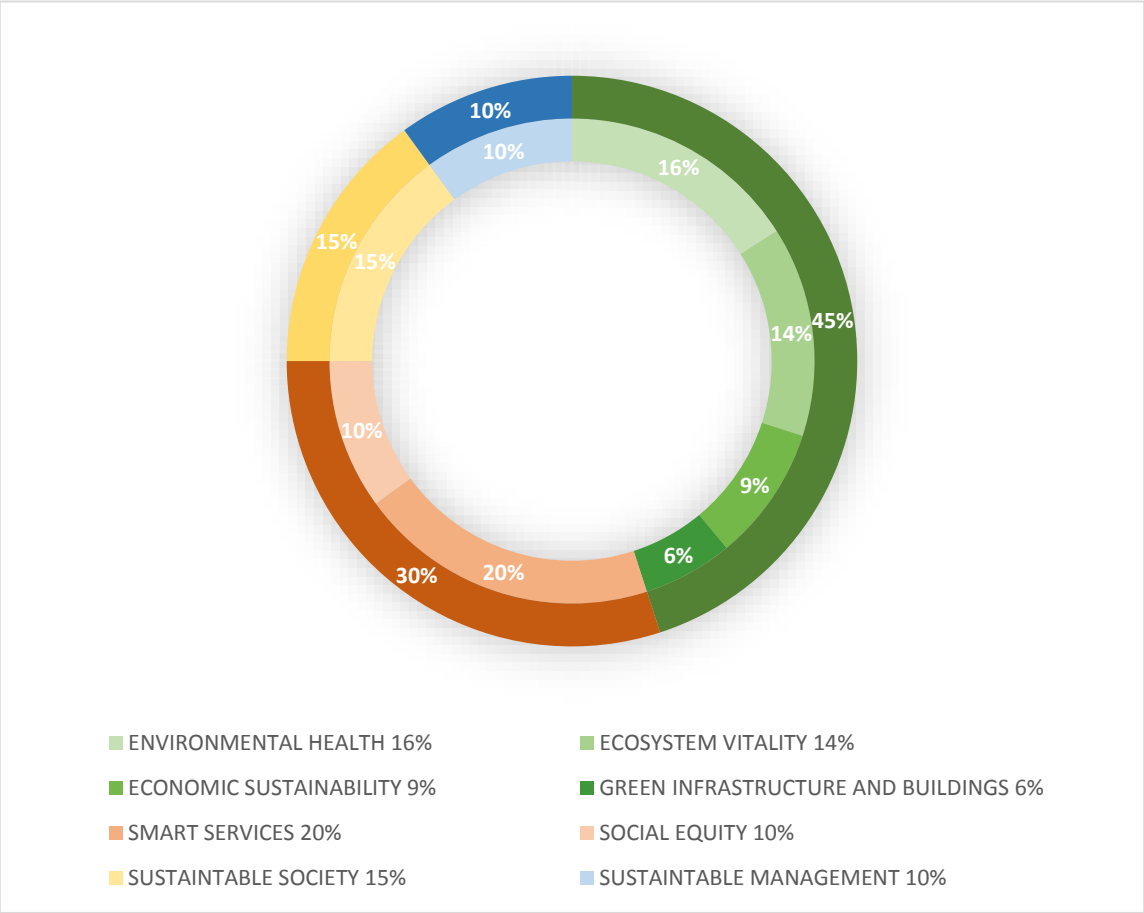

Fig 4.3: Sections Ponderation

Each section contains different categories of indicators that are divided in core and supporting ones (Table 4.1):

Table 4.1: Indicators division

SECTION	INDICATORS	CORE	SUPPORTING
ENVIRONMENTAL HEALTH	23	14	9
ECOSYSTEM VITALITY	20	9	11
ECONOMIC SUSTAINABILITY	12	6	6
GREEN INFRASTRUCTURE AND BUILDINGS	20	9	11
SMART SERVICES	51	22	29
SOCIAL EQUITY	23	14	9
SUSTAINABLE SOCIETY	21	9	21
SUSTAINABLE MANAGEMENT	11	6	5
TOTAL	181	89	101

By increasing the degree of discretization of the system, areas of evaluation, parameters and criteria were associated with each factor. Inputting data from certified organs (European Community, EUROSTAT ...) or from the individual cities, the analyzer can get a final evaluation of every aspect of sustainable development, based on the factors of weighting criteria and area.

The categories of the system contain indicators that are associated with different parameters and criteria. These are based on the study of the parameters of other systems, and sometimes some of them did not show the applicability to the European reality and therefore have been modified to meet this need. The target set for the formulation of this system and its applicability is not limited to the European reality, but the possibility to apply the international panorama.

The entire evaluation process, to simplify the processing of data relating to the assessment of the planning sustainability, helps to use a simple, objective and intelligent resource in the city.

The "SSUP" also allows a significant contribution to certain criteria to be taken into account at the design stage, providing some conditions for cities or future expansion.

4.07 ENVIRONMENTAL

The saving of environmental resources and their recovery and reuse is another fundamental concept to follow in planning sustainable urban spaces. It is necessary to optimize the consumption of natural resources and use them in a rational way, through the introduction of specific techniques is in the design phase that during construction. It is essential to follow the guidelines in order to rationalize the use of environmental resources given the limited themselves.

In a perspective of ecosystem, the city itself is a complex system, characterized by a continuous process of change and development, where aspects such as energy, natural resources and the production are seen as waste streams or cycles with interventions to keep them, restore them, turn them on and close them, contribute to sustainable development.

The approach is based on the principles of ecosystems and provides a framework for urban development at regional or local level. This Macro Area consists of 4 sections divided into several subcategories and indicators (core and supporting).

4.07.1 ENVIRONMENTAL HEALTH

In this era the exploitation of natural resources and the corresponding increase of pollution reached a peak. Taking in consideration that every year the world consumes earlier than before the yearly amount of resources that the planet offer, particular emphasis was put in peculiar indicators to promote a healthy planning and an attention on the exploitation and recycling.

This section has the main objective to analyse the environment of a specific area that can may affect the human health. It includes 5 different categories with in total 23 indicators (14 core and 9 supporting).

The criteria used in this group of indicators are the following:

Table 4.2: Environmental Health Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
AIR	PM_{10} Concentration	Concentration of PM10 per m^3
	SO_2 Concentration	Concentration of SO2 per m^3
	NO_2 Concentration	Concentration of NO2 per m^3
	Indoor Air Pollution	Air Quality Index
WATER	Access to Urban Water	Percentage of population that have direct access to water in urban areas
	Access to Rural Water	Percentage of population that have direct access to water in Rural areas
	Access to Drinking Water	Percentage of population that have direct access to freshwater
	Access to Sanitation	Percentage of population that have direct access to sanitation water
WASTE	Municipal Waste Intensity	Tons of waste produced yearly by the city in the selected area
	Industrial Solid Waste Intensity	Tons of waste produced yearly by industries in the selected area
	Municipal Solid Waste Treated	Percentage of waste treated in the selected area among the total produced
	Municipal Wastewater Treated	Percentage of wastewater treated in the selected area among the total produced
	Urban Human Waste Disposal	Number of structure for the disposal of human waste in urban area
	Rural Human Waste Disposal	Number of structure for the disposal of human waste in rural area
	Efficience Reuse of Waste	Percentage of Recycled waste
	Percentage of population with regular solid waste collection	Percentage of population with regular solid waste collection
NOISE	Noise level in selected areas	dB of noise in the selected area
	Infrastructure Noise	dB of noise due infrastructure
	Population exposed to long-term high level noise	Population Annoyance Index
POLLUTION	Light pollution reduction	Sky Brightness Index
	Heavy Metals	Percentage of heavy metals in water, air and land
	Hazardous pollution	Hazardous Waste Intensity
	Atmospheric pollution	Number of times exceeding atmospheric pollution

4.07.2 ECOSYSTEM VITALITY

A peculiar part in the environment system is given by the ecosystem vitality. With the disappearing of forest and the consequent increase of pollution, this study focalizes into the design of a living city in synergy with the nature giving importance in the reduction of emissions, protection of the habitat and resources.

This section has the main objective to analyse the ecosystem natural and artificial of a specific area that can may affect the human health. It includes 5 different categories with in total 20 indicators (9 core and 11 supporting).

The criteria used in this group of indicators are the following:

Table 4.3: Ecosystem Vitality Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
AIR	SO_2 emission	Concentration of SO_2 per m^3
	NO_2 emission	Concentration of NO_2 per m^3
WATER	Water provision	Water Scarcity Index
	Marine Protected Areas	Km^2 of protected coast and marine areas
	Freshwater Quality	Water Quality Index
	Freshwater Resources	Ratio of year stress on water resources
BIODIVERSITY	Terrestrial Protected Areas	Number of national parks
	Critical Habitat Protection	Km^2 of critical habitat protection areas
GREEN AREAS	Parks	Numbers of park in selected area
	Forest	Km^2 of land area covered by forest
	Soil Erosion	m^2 of soil erosion per year
	Use of Chemical products in agriculture	Percentage of use of chemical products in agriculture
	Green area	Green area (hectares) per 100,000 population
LAND MANAGEMENT	Population Density	Ratio between population and land area in km^2
	Building Density	Floor Area Ratio
	Infrastructure Density	Total km of railway and streets in a specific area
	Restoration of urban land	Percentage of investment in renovation of urban land
	Reuse of contaminated land	Percentage of contaminated land reused in a specific area
	Local food production	Percentage of local food production among the total food consumption
	Smart Location	Number of projects realized in the vicinity of the transport services

4.07.3 ECONOMIC SUSTAINABILITY

Resources are not infinite and the consequent exploitation have a deep impact in the environment system. The economy is a central aspect and it must be rethought with the perception of respect toward nature. Huge emphasis must be given in the rationalization of energy production, pollution and investments on green technologies.

This section has the main objective to analyse the economic sustainability of specific area that can may affect the environment health. It includes 5 different categories with in total 12 indicators (6 core and 6 supporting). The criteria used in this group of indicators are the following:

Table 4.4: Economic Sustainability Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
CLIMATE CHANGE	Weather conditions	Scale of weather vulnerability
	General pollution	CO_2 per Capita
	Air emissions intensities	CO_2 Intensity per capita
ENERGY	Energy Access	MWh per 1000 population
	Type of Energy	Ratio between the production of the energy with and without renewable sources
	Infrastructure Enegy Efficiency	Ratio between MWh produced and the losses due infrastructures
	Production of not Renewables Electricity	Percentage of energy production from not renewable sources
	Production of Renevables Electricity	Percentage of energy production from renewable sources
	Energy Supply	Total amount of energy produced in one month
	On-Site Energy Generation	Percentage of energy production structures in the selected area
ENVIRONMENTAL GOVERNANCE	Investment in Environment Protection	Amount of founds destined to prevention and protection
	Energy Incentives	Amount of founds destined to private renewable energy production

4.07.4 URBAN MORPHOLOGY

This section has the main objective to analyse the urban morphology of a specific area. Designing urban morphology is not just to define the shape of the places where people live, but it is an action that involves other aspects, such as knowing the connections between people and places, the streams, the nature of the spaces constructed and how they are popular, used and maintained.

The design of the urban morphology, to ensure the sustainable growth of an area for a long period, it must occupy both of design problems morphological space, architectural design, landscape, both of those outlined by the economic growth

From the morphological point of view the key elements to achieve the goal of sustainability are: to create a polycentric city and compact, ensuring a population density sufficient to ensure the survival of a functional mix, road design hierarchy, in order to facilitate the spread of mobility walking and cycling, integrated with public transport.

It includes 5 different categories with in total 20 indicators (9 core and 11 supporting). The criteria used in this group of indicators are the following:

Table 4.5: Urban Morphology

CATEGORY	INDICATORS	EVALUATION CRITERIA
URBAN MORPHOLOGY	Diversity of Building Types	Numbers of different kind of buildings with the S.D.I.[1]
	Average Heights of Buildings	Average height of buildings in a specific area
	Solar Orientation	Ratio between total vertical surfaces and vertical surfaces that face south
	Reuse of Historical Buildings	Percentage of reuse of historical buildings (renovations and reuse of materials)
	Green Transport	Percentage of green transport systems
	Walkable Street	Km² of pedestrian areas
	Certified Green Buildings	Number of certified green building
	Building Class	Average daily traffic
	Traffic	Km of cycle paths
	Bicyle Network	Percentage of high class structures
	Architectural Barriers	Percentage of direct access to structures for people with reduced mobility

4.08 SOCIAL

The category of social indicators are fundamental to create a homogeneous community and peaceful. Analysing the same local politics can implement different tools and reforms to better tailor the quality of life and services.

Particular attention should be given to the people with low incomes, poor employment, grade of education and reduced to integration of different ethnic groups. These factors are critical for the proliferation of social unrest and racial hatred and social closure that very often result in a high crime rate.

This Macro Area consists of 2 sections divided into several subcategories and indicators (core and supporting).

[1] Structure Density Index

4.08.4 SMART SERVICES

This section has the main objective to analyse the main services of a specific area with the objective to improve population life.

The need for policies to define sustainable development of mobility and services is necessary, in the first place, because the transport sector, and then of mobility in general, is one of the main sources of pollution of the cities, not only in terms of emissions harmful to the environment but also in terms of management of urban areas and soil.

Training and participation are two key elements to ensure that the citizen, that are the main user of the planning sustainable environment, develop a sense of belonging to the territory.

It includes 5 different categories with in total 51 indicators (22 core and 29 supporting). The criteria used in this group of indicators are the following:

Table 4.6: Smart Services Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
EDUCATION	Student/teacher ratio	Percentage of school-aged population enrolled in schools
	Primary Education	Percentage of school-aged population enrolled in secondary schools
	Secondary Education	Percentage of school-aged population graduated
	Education Structures Rate	Number of education structures per Km²
HEALTH	Mortality	Units of deaths per 1,000 individuals per year
	Birth Rate	Total number of live births per 1,000 of a population in a year
	Average life expectancy	Year of average life expectancy in the selected area
	Hospital Services Rate	Number of beds, nursing and midwifery personnel per 100,000 population
	Prevalence of Tobacco use	Kg of tobacco sold per 1,0000 population
	Mortality of major disease	Total number of death due major disease per 1,000 individuals per year
	Health Structures Rate	Number of health structures (public and private) per Km²
SAFETY	Homicide rate	Numbers of homicides per 100000 population
	Security force	Numbers of police officers per 100000 population
	Crime rate	Violent crime per 100000 population
	Safety Rate	Number of safety structures per Km²

Continuation of Table 4.6: Smart Services Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
FIRE & EMERGENCIES	Firefighting rate	Number of firefighters per 100,000 population
	Response time for fire department from initial call	Time elapsed between the dangerous situation and the arriving of forces
	Death due fire	Number of fire related deaths per 100,000 population
	Fire & Emergencies structures	Number of fire and emergencies structures per Km^2
TRANSPORTATION	High capacity public transit system	Km of high capacity public transit system per 100,000 population
	Light passenger transit system	Km of light passenger transit system per 100,000 population
	Personal automobiles	Number of personal automobiles per capita
	Diversification of transport system	Percentage of different transportation systems used in a specific area
	Eco-Friendly transport system	Number of public transit system using renewables energy or not polluting fuels per 1,000 population
	Mode of transportation used by children to travel between home and school	Percentage of use of public transportation by students
	Mode of transportation used by workers to travel between home and workplace	Percentage of use of public transportation by workers
	Reduced Mobility	Percentage of accessibility to transports for people with reduced mobility
HOUSING	Total number of households	Total number of households in the selected area
	Housing	Total number of occupied dwelling units (owned & rented)
	Persons per unit	Ration between population and number of houses in the selected area
	Dwelling density (per Square Kilometre)	Dwelling density (per Square Kilometre)
	Durable structures	Average age of structures without renovations in the selected area
	Affordable rental housing	Ratio of affordable rental house in a specific area
	Affordable for sale housing	Ratio of sale rental house in a specific area
	Slums	Percentage of population living in slums
	Authorized housing	Percentage of authorized housing on the total
	Evictions	Number of evictions per year
	Poor households	Percentage of population living in poor houses
	Secure tenure	Percentage of secure housing

Continuation of Table 4.6: Smart Services Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
CULTURE	Structures	Number of cultural structures in a specific area
	Investments	City expenditures on culture of overall city budget
	Events	Number of cultural events in a year
RECREATION	Indoor recreation facilities	Square metres of public indoor recreation space per capita
	Outdoor recreation facilities	Square metres of public outdoor recreation space per capita
	City investments	City expenditures on recreation of overall city budget
NATURAL HAZARDS	Hazard prone areas	Percentage of population living in hazard prone areas
	Human and economic loss due to natural disasters	Rate of loss per year due natural disasters
	Disaster prevention	Percentage of city budget destined to prevention
	Risk management	Percentage of city budget destined to risk management
INNOVATION	University	Number of higher education degrees per 100,000
	Incentives for use eco-friendly technologies	Percentage of the budget destined to incentives

4.08.5 SOCIAL EQUITY

A modern society should have as priority the wealth of its citizens and the social equity to prevent that part of population cannot have access to education or primary necessities. The ideal city is the one that doesn't leave behind anyone, that is multicultural and have a high rate of education, technology and integration.

This section has the main objective to analyse the social equity of a specific area that can may affect the life of the community. It includes 5 different categories with in total 23 indicators (14 core and 9 supporting).

Table 4.7: Social Equity Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
POPULATION	Children	Percentage of population that are children (0-14)
	Teenagers	Percentage of population that are youth (15-24)
	Adults	Percentage of population that are adult (25-64)
	Senior citezens	Percentage of population that are senior citizens (65+)
	Male and female population	Male to female ratio (# of males per 100 females)
	Annual population change	Rate between death and emigration with new births and immigrations
	Foreign population	Percentage of population that are foreign born
	Immigrants	Percentage of population that are new immigrants
	Internal migration	Percentage of population that are migrating from elsewhere in the country
	Integration	Rate of integration of foreign population
POVERTY	Population in poverty	Percentage of city population living in poverty
	Homeless people	Number of homeless people per 100,000 population
	Income inequality	Rate between the wealth of rich citizen compared to the salary of low class citizens

4.09 ECONOMY

The category of economy contains all the features necessary to create a sustainable economy for a community. Analysing the financial aspect of the society is possible to develop the right reforms and improvement for a better style of life.

This Macro Area consists in 1 section divided into several subcategories and indicators (core and supporting).

4.09.1 SUSTAINABLE SOCIETY

Economy is a key factor in the life of a city but as well having a sustainable society has its revenues. The possibility of giving high standard services with a lower price of housing, low rate of unemployment and absence of poverty could be a dream but it can be achieved taking in account different aspects to prevent social disparity. The implementation of tourism, research and development, education are just few example of what a sustainable society could affect the economy of the city.

This section has the main objective to analyse the economy and its grade of sustainability in a specific area that can may affect the life of the community. It includes 3 different categories with in total 21 indicators (9 core and 12 supporting).

Table 4.8: Sustainable Society Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
ECONOMIC DEVELOPMENT	Cost of living	Cost of living per capita per month
	Total employment	Percentage of employment
	Rate of women in employment	Percentage of women in employment
	Full time employment Rate	Percentage of persons in full time employment
	Businesses Rate	Number of Businesses per 1000 Population
	Unemployment rate	Annual average unemployment rate
	Information and communication technologies	Number of internet connections per 100,000 population
	Research and development	Number of new patents per 100,000 per year
	Tourism	Percentage of visitors per year
	Inflation Rate	Inflation rate per year
FINANCE	Debt service ratio	Ratio of debt service payments of a country to that country's export earnings
	Tax collected Rate	Tax collected as percentage of tax billed
	Own-source revenue Rate	Own-source revenue as a percent of total revenues
	Capital spending Rate	Capital spending as percentage of total expenditures
	Private investment in public sustainability projects	Percentage of private investments in public sustainability projects
	Public investment in public sustainability projects	Percentage of public investments in public sustainability projects
RESOURCES	Price of water	Price of freshwater per m^3
	Price of energy	Price of electric energy per Kwh
	Price of land in urban area	Price of land in urban area per m^2
	Price of land in rural area	Price of land in rural area per ha
	Price of materials	Price of construction material (concrete, blocks and manpower) to build a m^3

4.10 GOVERNANCE

The category of governance determine the impact of consciousness of a society for the wealth of citizens and the possibility of investments in building a better city. Aspects such as bribes and corruption are included to give a completeness to the analysis of the local structure and political power. Taking as reference the democratic system with a large and active participation of population in the political decisions, particular attention was given to the participation of women in the governance, incentives destined to eco-policies and competition among similar companies.

4.10.1 SUSTAINABLE MANAGEMENT

The governance has the biggest impact in the future of the city due the fact that it is the aspect that take decision and mark the way to follow. Many key factors are involved in it and they affect directly the sustainability of the system.

This section has the main objective to analyse the management and its grade of sustainability in a specific area that can may affect the life of the community. It includes 1 category with in total 11 indicators (6 core and 5 supporting).

Table 4.9: Sustainable Management Indicators

CATEGORY	INDICATORS	EVALUATION CRITERIA
GOVERNMENT	Type of government (e.g. Local, Regional, County)	Number of government structures in the area
	Gross operating budget	Amount of gross operating budget per year
	Gross capital budget	Amount of gross capital budget per year
	Women in the goverment	Percentage of women employed in the city government workforce
PARTECIPATION	Civic associations	Number of civic associations per 1,000 population
	Citiziens partecipation	Percentage of citizens participation to events
EFFICENCY	Corruption	Rate of corruption (billions of euros per 1000 population)
	Bribes	Rate of receiving bribes (billions of euros per 1000 population)
	Competitive Index	Rate of similar companies and services operating in the same sector per 1000 population
	Enviromental and social management	Rate of adopting environmental and social management procedures
	Rate of incentives for eco-friendly procedures	Billions of euros destined to incentive eco-friendly procedures

4.11 STRUCTURE OF "SSUP"

The system "SSUP" is designed to simplify the implementation and understanding regarding the evaluation and certification of sustainable urban planning. To simplify the assessment, each component, factor, areas, parameter and evaluation criterion is assigned a unique reference, which allows you to quickly identify; if it is found that any criteria has not been evaluated or tested, can then be analyzed, with the possibility change.

Taking as an example the following reference "EC-S 2-5" are: EC-S - Letter related to the category "Economic Sustainability" of the Environmental Macro Area; 2 – Letter related to the category of "Energy"; 5 - Letter concerning the assessment factor of the production of energy from renewable sources (Fig. 4.4).

PRODUCTION OF RENEWABLES ENERGY 		SSUP
CODE: EC-S 2-5	Avaiable Points: 1	Average Points: 0,6
Description:		
The indicator analyses the production of energy through renewables.		
Objective:		
Incentivates the productions of energy through renewables.		
Evaluation Criteria:		
Ratio of all the kind of renewables produced in a year		
Applicability		
City and buildings		
Data:		Value Units
∑Et (x) =all kind of energy produced in year (x)		
Er (x) = renewables production in year (x)		
Calculus		Result
$Rw = (\frac{Er(x)}{\sum Et(x)}) * 100$		
Threshold:	Points:	Evaluation
0 < Rw < 2,5	0,20	
2,5 < Rw < 10	0,40	
10 < Rw < 25	0,60	
25 < Rw < 60	0,80	
60 < Rw < 100	1	

Fig 4.4: Example form

The assessment begins with the release of the requested data, in this case: all Kw / h of energy produced in a year from any kind of source and Kw / h produced by renewable energy. The system automatically performs the calculation and based on the result is assigned a score corresponding to 5 different ranges.

The sum of all ranges of each indicator produces the final result.

4.12 HOW THE "SSUP" WORKS

As a first step, the technician responsible for the assessment must only fill sheets relating to valuation metrics. For each category there is created a spreadsheet in which there are different criteria used to judge a certain parameter. Thus, the technician must only enter the data and automatically calculates the score (Table 4.10 and ANNEX).

Table 4.10: SSUP working system

CATEGORY		INDICATOR		DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
ENVIRONMENTAL									
ENVIRONMENTAL HEALTH									
EN-H 1	AIR	EN-H 1-1	PM10 Concentration	-	%	1	0,6	-	
		EN-H 1-2	SO2 Concentration	-	%	1	0,6	-	
		EN-H 1-3	NO2 Concentration	-	%	1	0,6	-	
		EN-H 1-4	Indoor Air Pollution	-	%	1	0,6	-	
EN-H 2	WATER	EN-H 2-1	Access to Urban Water	-	%	0,6	0,4	-	
		EN-H 2-2	Access to Rural Water	-	%	0,4	0,3	-	
		EN-H 2-3	Access to Drinking Water	-	%	1	0,6	-	
		EN-H 2-4	Access to Sanitation	-	%	1	0,6	-	

By filling out the form the technician can have the perception that certain criteria have weight given to different than other parameters, and these in relation to the assessment of this factor.

If they are not in possession of a given data, the system will give the minimum rating in that parameter, this is because the system is calibrated at the lower score.

In the main sheet system, there is the summary with the total score is divided into major categories and annotations about the lack of data in some parameters. Therefore, the evaluator can quickly see which failed to meet the criteria, and suggest measures to be taken to the amount of the assessment.

The system of evaluation and certification "SSUP" consists of a range of values of reference at the end of the global analysis of all the criteria given by an evaluation according to the levels previously established. The levels of certification system generated with a scale of Maurice is based on the study of previously discussed and studied, with the goal of making a city more sustainable (Fig. 4.5).

Therefore, if a city or portion of it reaches a final evaluation "sustainable" in the certification system must ensure a minimum percentage for each evaluation area in order to obtain a minimum level of performance.

LEVEL OF CERTIFICATION	GRADE	SCORE
Excellent	A+	100-95
Optimal	A	95-85
Good	B	85-80
Sufficient	C	80-70
Inadequate	D	70-60
Poor	E	60-50
Very Bad	F	50-0

Fig. 4.5: Certification Scores

4.13 THE MONITORING SYSTEM

If the project and planning phase is fundamental for the realization of the objective, the monitoring phase result important to respect them. The "SSUP" system is based on 181 indicators (81 core, 189 supporting) for the evaluation and realization of sustainable urban planning. The monitoring system uses part of them: the Core indicators (Fig. 4.6).

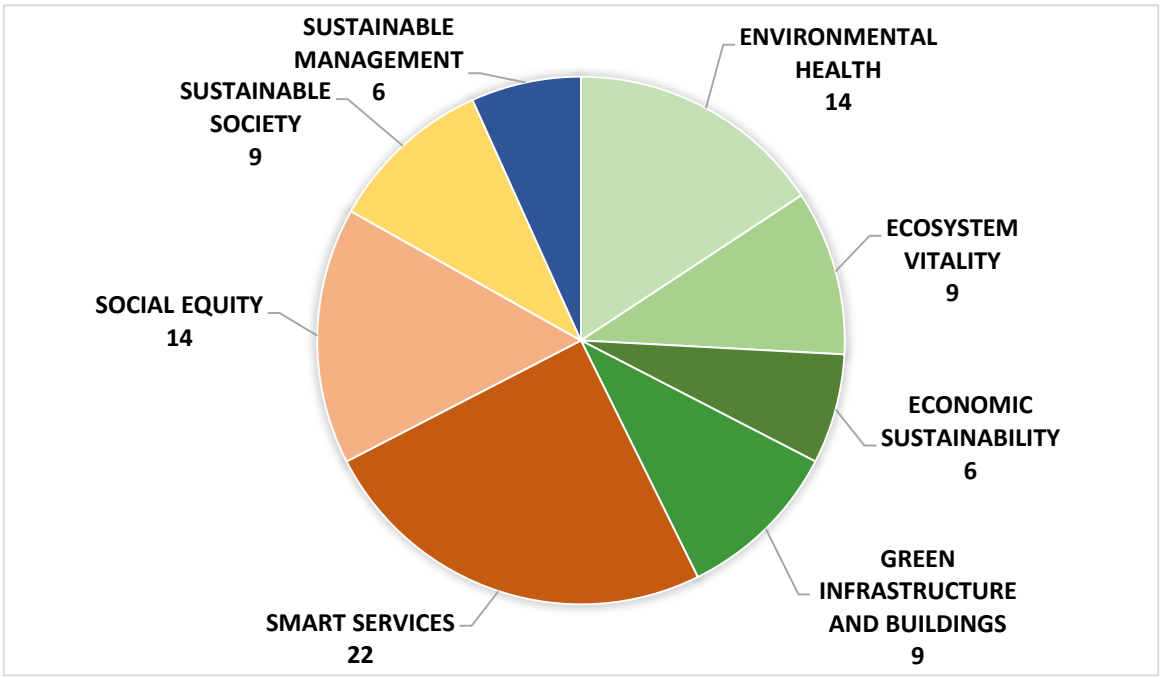

Fig. 4.6: Monitoring Ponderation

Those indicators cover all the categories, focalizing in the principal aspects involved in the sustainability planning such as production of renewable energy, architectural barriers, population in poverty or cost of living.

They are compulsory for the achievement of the objectives in the planning process and have the biggest weight on the evaluation process. This system was designed like that to give an immediate and easy to read response to a different range of aspects involved. Clearly if one of the score or more in the indicators system will be out of scale or produce an error in the monitoring phase, that will evidence the necessity to improve or change the feature in the project.

The monitoring system is set to evaluate and compare the values of the Core indicators used during the project phase. The evaluator or an automatic system can simply fill the table (Table 4.11 and ANNEX) with the data and immediately can get the evaluation of the analysed territory.

Table 4.11: SSUP Monitoring System

CATEGORY		INDICATOR		PROJECT DATA	PROJECT POINTS	AVERAGE POINTS	ACTUAL DATA	ACTUAL POINTS	EVALUATION
ENVIRONMENTAL									
ENVIRONMENTAL HEALTH									
EN-H 1	AIR	EN-H 1-1	PM10 Concentration	-	-	0,6	-	-	
		EN-H 1-2	SO2 Concentration	-	-	0,6	-	-	
		EN-H 1-3	NO2 Concentration	-	-	0,6	-	-	
		EN-H 1-4	Indoor Air Pollution	-	-	0,6	-	-	
EN-H 2	WATER	EN-H 2-3	Access to Drinking Water	-	-	0,6	-	-	
		EN-H 2-4	Access to Sanitation	-	-	0,6	-	-	

4.14 DISCUSSION OF THE SYSTEM

The system, unlike those already exposed in the previous chapter, is more complete and reliable for the assessment of sustainable urban planning. The selection of indicators is of crucial importance for the proper achievement of the objectives.

The great weight given to the environmental category is a choice to promote the decarbonisation of the urban areas. The phase of monitoring, based on the core indicators, could, in the near future, be accompanied by a digital platform based on geographic maps (GIS) and real-time data for better control of the territory.

Finally, the ductility of “SSUP” may allow it to become a tool used by the city for their future planning, management and expansion.

PART 5: CONCLUSIONS

5.1 CONCLUSIONS

Sustainable development, the reduction of CO_2 emissions, the production of clean energy, the less use of resources were key policies of many countries. However, the innumerable conferences and treaties signed, have not produced great results.

The non-uniformity and the non-respect of treaties and agreements (Kyoto Treaty, European environmental policies), makes that the concept of sustainability remains a mirage.

Every country should be aware that the planet we live on is not eternal and therefore must be preserved.

Based on these principles, it's necessary to create a system of measures and approaches able to counter this situation. Very often the words of the policy result inefficient and sometimes at odds with the idea of creating an environment more sustainable and liveable.

The thesis work was aimed to verify the integration of sustainability assessment in the design process and adjustment of the city. The assessment, in fact, was considered a real design tool intended, the latter, as a cyclical process of drawing the processing and verification of environmental quality.

The work done has allowed us to verify also that the multidimensional and intersectional its objective of sustainability, can be transformed into criteria capable of guiding the project action.

The idea of integration has been duly verified by developing a system "SSUP" of urban sustainability indicators specifically oriented to capture the effectiveness of urban form. In particular, downstream of a search on the existing evaluation systems (LEED ND, LIDERA, M. AMADO, etc.) Has been constructed an evaluation matrix specifically inspired by a model of the city compact and efficient that can guide the design.

The evaluation matrix, operational tool of a multi-dimensional and multi-sectorial approach, wants to respond to the challenges posed by the complexity of the city, and is configured as an assessment tool of multicriteria. The set of criteria is divided into categories related to different aspects of the complex city system.

Each indicator in the "SSUP" has been calibrated to meet the Standard Europeans in the field of environmental sustainability. They have a weight and a different value according to the category they belong. A key criterion was to consider the selection of parameters for an international application that can ensure uniformity of opinion among the different communities due to its flexibility and objectivity.

Finally, the analysis system issues a system of evaluation and certification of urban sustainability through a scale of Maurice where the minimum acceptable level appears to be between 80-85 points.

The calibration of the "SSUP" is highly necessary to "wake up" the conscience of regional policies, national and international sustainability.

5.2 FUTURE DEVELOPMENTS

The system "SSUP" for the evaluation and certification of sustainable urban planning collects in if a large number of data, but for its function of automatic calculation turns out to be particularly fast.

The collection of data in some cases may be slow because not all communities have access to the tools needed for their collection.

In the future the “SSUP" can be integrated in a system of automatic calculation that can give results with pre-time rate stability (days, weeks, months) associated to a geographic multimedia map (GIS) for have a better utility in the planning of future cities.

With the progress of economic, cultural and social indicators can be integrated and modified to define a level of sustainability current with the times.

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ANNEX

EUROPEAN CITY INDEX

List of categories, indicators and their weightings

Category	Indicator	Type	Weighting	Description	Normalisation technique
CO_2	**CO_2 emissions**	Quantitative	33%	Total CO_2 emissions, in tonnes per head.	Min-max.
	CO_2 intensity	Quantitative	33%	Total CO_2 emissions, in grams per unit of real GDP (2000 base year).	Min-max; lower benchmark of 1,000 grams inserted to prevent outliers.
	CO_2 reduction strategy	Qualitative	33%	An assessment of the ambitiousness of CO_2 emissions reduction strategy.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Energy	**Energy consumption**	Quantitative	25%	Total final energy consumption, in gigajoules per head.	Min-max.
	Energy intensity	Quantitative	25%	Total final energy consumption, in megajoules per unit of real GDP (in euros, base year 2000).	Min-max; lower benchmark of 8MJ/€GDP inserted to prevent outliers.
	Renewable energy consumption	Quantitative	25%	The percentage of total energy derived from renewable sources, as a share of the city's total energy consumption, in terajoules.	Scored against an upper benchmark of 20% (EU target).
	Clean and efficient energy policies	Qualitative	25%	An assessment of the extensiveness of policies promoting the use of clean and efficient energy.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Buildings	**Energy consumption of residential buildings**	Quantitative	33%	Total final energy consumption in the residential sector, per square metre of residential floor space.	Min-max.
	Energy-efficient buildings standards	Qualitative	33%	An assessment the extensiveness of cities' energy efficiency standards for buildings.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Energy-efficient buildings initiatives	Qualitative	33%	An assessment of the extensiveness of efforts to promote energy efficiency of buildings.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Transport	**Use of non-car transport**	Quantitative	29%	The total percentage of the working population travelling to work on public transport, by bicycle and by foot.	Converted to a scale of 0 to 10.
	Size of non-car transport network	Quantitative	14%	Length of cycling lanes and the public transport network, in km per square metre of city area.	Min-max. Upper benchmarks of 4 km/km^2 and 5 km/km^2 inserted to prevent outliers.
	Green transport promotion	Qualitative	29%	An assessment of the extensiveness of efforts to increase the use of cleaner transport.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Congestion reduction policies	Qualitative	29%	An assessment of efforts to reduce vehicle traffic within the city.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Water	**Water consumption**	Quantitative	25%	Total annual water consumption, in cubic metres per head.	Min-max.
	Water system leakages	Quantitative	25%	Percentage of water lost in the water distribution system.	Scored against an upper target of 5%.
	Wastewater treatment	Quantitative	25%	Percentage of dwellings connected to the sewage system.	Scored against an upper benchmark of 100% and a lower benchmark of 80%.
	Water efficiency and treatment policies	Qualitative	25%	An assessment of the comprehensiveness of measures to improve the efficiency of water usage and the treatment of wastewater.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Waste and land use	**Municipal waste production**	Quantitative	25%	Total annual municipal waste collected, in kg per head.	Scored against an upper benchmark of 300 kg (EU target). A lower benchmark of 1,000 kg inserted to prevent outliers.
	Waste recycling	Quantitative	25%	Percentage of municipal waste recycled.	Scored against an upper benchmark of 50% (EU target).
	Waste reduction and policies	Qualitative	25%	An assessment of the extensiveness of measures to reduce the overall production of waste, and to recycle and reuse waste.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Green land use policies	Qualitative	25%	An assessment of the comprehensiveness of policies to contain the urban sprawl and promote the availability of green spaces.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Air quality	**Nitrogen dioxide**	Quantitative	20%	Annual daily mean of NO_2 emissions.	Scored against a lower benchmark of 40 ug/m^3 (EU target).
	Ozone	Quantitative	20%	Annual daily mean of O_3 emissions.	Scored against a lower benchmark of 120 ug/m^3 (EU target).
	Particulate matter	Quantitative	20%	Annual daily mean of PM^{10} emissions.	Scored against a lower benchmark of 50 ug/m^3 (EU target).
	Sulphur dioxide	Quantitative	20%	Annual daily mean of SO_2 emissions.	Scored against a lower benchmark of 40 ug/m^3 (EU target).
	Clean air policies	Qualitative	20%	An assessment of the extensiveness of policies to improve air quality.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Environmental governance	**Green action plan**	Qualitative	33%	An assessment of the ambitiousness and comprehensiveness of strategies to improve and monitor environmental performance.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Green management	Qualitative	33%	An assessment of the management of environmental issues and commitment to achieving international environmental standards.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Public participation in green policy	Qualitative	33%	An assessment of the extent to which citizens may participate in environmental decision-making.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.

NUMBER	TITLE	POINTS	BRIEF DESCRIPTION
Smart Location and Linkage		**27 Points Possible**	
Prereq 1	Smart Location	Required	Develop on a site that is infill, connected to adjacent development, or served by transit or neighborhood amenities.
Prereq 2	Imperiled Species and Ecological Communities	Required	Conserve any on-site imperiled species and habitat.
Prereq 3	Wetland and Water Body Conservation	Required	Do not build near or on wetlands or water bodies.
Prereq 4	Agricultural Land Conservation	Required	Protect prime agricultural land.
Prereq 5	Floodplain Avoidance	Required	Prevent most building on floodplains.
Credit 1	Preferred Locations	1-10	Develop on a site that is highly accessible and connected to other nearby development.
Credit 2	Brownfield Redevelopment	1-2	Remediate a contaminated site and redevelop.
Credit 3	Locations with Reduced Automobile Dependence	1-7	Develop in an area that is well-served by transit or has a low average driving rate.
Credit 4	Bicycle Network and Storage	1	Locate along a bicycle network and provide bicycle storage and parking.
Credit 5	Housing and Jobs Proximity	1-3	Locate jobs and housing, particularly affordable housing, nearby each other.
Credit 6	Steep Slope Protection	1	Protect steep slopes from development.
Credit 7	Site Design for Habitat or Wetland and Water Body Conservation	1	Conserve pre-existing on-site habitat, wetlands, or water bodies in perpetuity.
Credit 8	Restoration of Habitat or Wetlands and Water Bodies	1	Restore degraded on-site habitat, wetlands, or water bodies, and conserve in perpetuity.
Credit 9	Long-Term Conservation Management of Habitat or Wetlands and Water Bodies	1	Implement a long-term management plan for on-site habitat, wetlands, or water bodies.
Neighborhood Pattern and Design		**44 Points Possible**	
Prereq 1	Walkable Streets	Required	Include public-facing building entries, building heights appropriate to street widths, continuous sidewalks, and limited garage entries.
Prereq 2	Compact Development	Required	Meet minimum density thresholds.
Prereq 3	Connected and Open Community	Required	Connect neighborhood streets to each other and adjacent areas.
Credit 1	Walkable Streets	1-12	In addition to complying with the items in Prerequisite 1 above, improve the pedestrian experience at the street level by providing: frequent building entries, ground-level windows, on-street parking, elevated ground-floor units, low street speeds, and/or minimal driveway interruptions of sidewalks.
Credit 2	Compact Development	1-6	Add homes and/or nonresidential space to make efficient use of land.
Credit 3	Mixed-Use Neighborhood Centers	1-4	Provide neighborhood shops, services, and amenities clustered in neighborhood centers within walking distance of residents and each other.

Credit 4	Mixed-Income Diverse Communities	1-7	Provide diverse housing types and affordability levels.
Credit 5	Reduced Parking Footprint	1	Minimize surface parking lots and discourage them along building frontages. Also provide bicycle and car-share parking.
Credit 6	Street Network	1-2	Provide superior connection of streets to each other and adjacent areas, and avoid cul-de-sacs.
Credit 7	Transit Facilities	1	Include shelters, benches, lighting, and information displays at transit stops.
Credit 8	Transportation Demand Management	1-2	Encourage use of environmentally preferable transportation choices with transit passes, shuttles, vehicle sharing, and/or unbundled parking pricing.
Credit 9	Access to Civic and Public Spaces	1	Provide squares, parks, and plazas within walking distance of residents and commercial tenants.
Credit 10	Access to Recreation Facilities	1	Provide indoor or outdoor recreational facilities.
Credit 11	Visitability and Universal Design	1	Design public spaces and dwelling units for all abilities.
Credit 12	Community Outreach and Involvement	1-2	Base project designs on community input.
Credit 13	Local Food Production	1	Provide access to gardening space, local produce, or a farmer's market.
Credit 14	Tree-Lined and Shaded Streets	1-2	Line and shade streets with trees.
Credit 15	Neighborhood Schools	1	Locate within walking distance to local schools.
Green Infrastructure and Buildings		**29 Points Possible**	
Prereq 1	Certified Green Building	Required	Include at least one building certified under LEED or a similar green building rating system.
Prereq 2	Minimum Building Energy Efficiency	Required	Meet minimum requirements for building energy efficiency.
Prereq 3	Minimum Building Water Efficiency	Required	Meet minimum requirements for building water efficiency.
Prereq 4	Construction Activity Pollution Prevention	Required	Implement an erosion and sedimentation control plan for construction.
Credit 1	Certified Green Buildings	1-5	Include multiple buildings certified under LEED or a similar green building rating system.
Credit 2	Building Energy Efficiency	1-2	Provide superior building energy efficiency.
Credit 3	Building Water Efficiency	1	Provide superior building water efficiency.
Credit 4	Water-Efficient Landscaping	1	Reduce water consumption for outdoor landscaping.
Credit 5	Existing Building Use	1	Reuse existing buildings.
Credit 6	Historic Resource Preservation and Adaptive Use	1	Reuse and restore historic buildings.
Credit 7	Minimized Site Disturbance in Design and Construction	1	Preserve heritage trees and previously undeveloped land.
Credit 8	Stormwater Management	1-4	Retain and treat stormwater on-site.
Credit 9	Heat Island Reduction	1	Use roofing and paving that reflects instead of absorbs solar heat.

Credit 10	Solar Orientation	1	Increase passive and solar access by orienting buildings or dense blocks to maximize north- and south-facing exposure.
Credit 11	On-Site Renewable Energy Sources	1-3	Generate renewable energy on-site.
Credit 12	District Heating and Cooling	2	Provide building heating and cooling through a shared neighborhood-wide system.
Credit 13	Infrastructure Energy Efficiency	1	Provide energy-efficient neighborhood infrastructure.
Credit 14	Wastewater Management	1-2	Reuse treated wastewater.
Credit 15	Recycled Content in Infrastructure	1	Use recycled content in neighborhood infrastructure.
Credit 16	Solid Waste Management Infrastructure	1	Provide neighborhood composting, recycling, and hazardous waste collection.
Credit 17	Light Pollution Reduction	1	Limit exterior illumination and direct it downward.
Innovation and Design Process		**6 Points Possible**	
Credit 1	Innovation and Exemplary Performance	1-5	Exhibit exemplary environmental performance in areas not addressed by the LEED-ND rating system.
Credit 2	LEED Accredited Professional	1	Have a team member that is: a LEED Accredited Professional, and credentialed in smart growth by the Natural Resources Defense Council and Smart Growth America, or credentialed in new urbanism by the Congress for the New Urbanism.
Regional Priority Credit		**4 Points Possible**	
Credit 1	Regional Priority Credit	1-4	Address geographically specific environmental, social equity, or public health priorities.
Project Totals (Certification estimates)		**110 Points Possible**	
Certified: 40-49 points	**Silver:** 50-59 points	**Gold:** 60-79 points	**Platinum:** 80+ points

Quadro 1 - Sistema LiderA, orientações e aplicação em cada fase do ciclo de vi

NIVEL 1	LIDERA 2.00d1			LIDERA SISTEMA DE AVALIAÇÃO DA SUSTENTABILIDADE - CRITÉRIOS PARA A CONSTRUÇÃO SUSTEN			
VERTENTE	**ÁREA**	**Wi**	**Pre-Req.**	**CRITÉRIO**	**NºC**	**LINHAS DE BOA PRÁTICA**	
INTEGRAÇÃO LOCAL	SOLO	7%	S	Valorização territorial	C1	Construir em áreas degradadas ou abandonadas (já intervencionadas), com solo contaminado, as quais deverão ser descontaminados. Construir em zonas infra-estruturadas de redes de esgotos e água. Respeitar e salvaguardar as condicionantes e as áreas sensíveis (PDM). Utilizar zonas já impermeabilizadas ou construídas para colocação de estaleiros, minimizando o impacte das operações de construção sobre o solo	Definir e verificar a situação inicial de todas as áreas intervenção e a efectuar ou realizadas na intervençã medidas a serem tomadas a nível estratégico do loc
				Optimização ambiental da implantação	C2	Reduzir a área de implantação do edifício e zonas afins. Por exemplo construir sobre estacas: permite minimizar a área de solo ocupada por cada edifício, minimizando portanto a área impermeabilizada.	Definir todas as áreas consideradas relevantes (brut
	ECOSSISTEMAS NATURAIS	5%	S	Valorização ecológica	C3	O desenvolvimento deve potenciar o valor ecológico do local: deve-se tentar manter, no local, todas as espécies fauna e flora (em especial as endémicas), procurando ainda aumentar a biodiversidade e/ou área ecológica presente.	Verificar a percentagem de área verde face à área to permaneceram ou foram inseridas) após a intervenç
				Interligação de habitats	C4	Promover a continuidade da estrutura verde nas zonas envolventes: coberturas, fachadas verdes, arborização nas ruas, zonas verdes de modo a favorecer a interligação de habitats. Evitar a existência de barreiras/obstáculos físicos entre habitats ou no mesmo habitat; colocar estruturas (tocas, ninhos, etc.) que favoreçam o desenvolvimento de espécies.	Avaliar a percentagem de habitats existentes de mod através da análise da forma e do tipo de estrutura ve (exteriores ao lote), caso estes existam. Contabilizar habitat
6 Critérios	PAISAGEM E PATRIMÓNIO	2%	S	Integração paisagística	C5	Fomentar a integração ou valorização paisagística através de algumas medidas possíveis de integração na bacia visual da zona: a utilização de uma palete de cores dentro das existentes no local, utilização de materiais de acordo com os tipicamente utilizados na circundante e a inserção visual na circundante (numa área montanhosa a construção tipicamente montanhosa, construção típica e ajustada à região, construção numa zona histórica manter o tipo de fachada da área, etc.), alturas semelhantes à existente no local (altura 2 pisos superior ou inferior à média do quarteirão)	Elaborar uma caracterização do local envolvente e p projecto arquitectónico, aspectos naturais, materiais, no local. Verificar o tipo de materiais e cores utilizada crítica com a proposta de intervenção.
14%				Protecção e valorização do património	C6	Assegurar, que sempre que tenha interesse patrimonial e o seu estado o permite, condições de conservação do edificado. No caso de necessitar de intervenção proceder à sua efectivação de forma adequada, quer em termos de reabilitação, quer em termos de restauro. Relação formal do edifício com o património envolvente (construído ou natural) e adequação do uso ao tipo de ambiente.	Avaliar e quantificar as medidas que ao nível do edi
RECURSOS	ENERGIA	17%	S	Eficiência nos consumos - Certificação energética	C7	Cumpre a lei em vigor da Certificação Energética, preferencialmente com classes de melhor nível, nomeadamente nível A e A+. Reduzir os consumos energéticos - Monitorização dos consumos de energia e verificação dos valores da certificação energética. Estas soluções devem ser adoptadas ao local e à situação edificada existente.	Monitorizar os consumos de energia e verificar o cur - e a redução do nível de consumos energéticos. Conformidade com RCCTE e RSECE e valores relac
				Desenho passivo	C8	Diminuição (em mais de 50%) das necessidades nominais de energia pela adopção de práticas bioclimáticas e de desempenho solar passivo, para o Verão e Inverno. Parâmetros aplicáveis: orientação do edifício, isolamento térmico, factor de forma, sombreamento, fenestração, etc.	Estimar condições e gastos energéticos kWh/m2.ano nesta área, apurando os seus benefícios.
				Intensidade em carbono	C9	Redução do nível de emissões de CO2 a partir de fontes de energia renováveis e quantidade de energia produzida no total. Produção de electricidade a partir de fontes renováveis: energia fotovoltaico, energia eólica (ou vento da cidade), cogeração, entre outras. Seleccionar o número de equipamentos (electrodomésticos, lâmpadas...) existentes, com boa classificação de eficiência energética, bem como aumentar a percentagem de energia renovável que é produzida no edifício. Medidas a implementar: as necessidades energéticas para as AQS são supridas por colectores solares; as necessidades de electricidade são asseguradas por fontes renováveis: solar, eólica entre outras. Em última prioridade a possibilidade de utilização de sumidouros.	Determinação da redução do nível de emissões de C produzida no total. Definir número de equipamentos nível e tipo de equipamento; AQS; Fotovoltaicos; Bio
	ÁGUA	8%	S	Consumo de água potável	C10	Reduzir o consumo de água primária proveniente da rede de abastecimento público (deverá rondar os 80 l/hab.dia e de água secundária os 95 l/hab.dia, representando o primeiro, uma redução superior a 50% face à prática actual). Tipo de equipamentos eficientes a utilizar: uso de torneiras com redutor, exemplo torneiras misturadora; uso de torneiras com sensores; autoclismo de dupla descarga ou sistema sanitário "waterless"; 2. utilização de águas pluviais para consumo secundário; 3. sistemas de monitorização, além dos contadores de água e acessíveis aos utilizadores; 4. limite de distribuição de água potável consoante o uso do edifício/ tipo de utilizadores. Reduzir as necessidades de água no espaço exterior.	Definir os consumos de água potável em litros/hab.d utilizando os contadores públicos ou próprios ou pro o controlo dos consumos e perdas e sua eficiência.
				Gestão das águas locais	C11	Algumas medidas possíveis: elaboração de planos de captação e protecção dos aquíferos locais; tipo de rega efectuada; plano de gestão de águas locais, retenção, tratamento e descarga de águas de escorrência no local: tipos de retenção e tratamento local: terrenos pantanosos, lagos de sedimentação, piscinas de retenção, bacias de infiltração, cursos de drenagem, filtros (biológicos);Tomar medidas, no local, para reduzir em % a escorrência de águas pluviais anual, em: parques de estacionamento, superfícies impermeabilizadas e telhados e coberturas; minimização da descarga de efluentes; tipo de vegetação utilizada nas áreas ajardinadas, por forma a reduzir as necessidades de água e de utilização de químicos (evitando a contaminação das águas locais) e a aumentar os níveis de infiltração.	Definir a percentagem de escorrências locais antes e locais com a sua eficiência.
	MATERIAIS	5%	S	Durabilidade	C12	Projectar utilizando materiais duráveis, de modo a que o seu tempo de vida seja longo, bem como potenciar a sua conservação e manutenção. Medidas a considerar entre outras: 1. Redes prediais 25 anos; 2. Acabamentos para 5 anos; 3. Equipamentos (elevadores, instalação eléctrica, sensores interiores e exteriores, painel solar, fovoltovoltaico, tratamento de efluentes, caldeira, etc.) entre 5 a 10 anos. Sendo que se considera que o peso da durabilidade da estrutura e dos acabamentos é muito mais importante do que os outros, face às necessidades e periodicidades de intervenção.	Avaliar a percentagem de aumento da durabilidade permitem reduzir o consumo de materiais e/ou alter vida de cada material.
				Materiais locais	C13	Utilização de materiais produzidos a menos de 100 km (superior a 50 %).	Estimar ou calcular a quantidade (em kg ou equivale intervenção, estipulando a sua percentagem face ao
9 Critérios				Materiais de baixo impacte	C14	Utilização de materiais certificados ambientalmente, reciclados e/ou renováveis e de baixo impacte, sendo que se devem evitar (por serem perigosos) materiais que contenham os seguintes compostos: chumbo, amianto, arsénico, cádmio, mercúrio, sulfato, benzeno, solventes clorados, PCB, PCT, formaldeído, crómio, creosote, resinas fenólicas, entre outros.	Estimar ou calcular a quantidade de materiais (em kg provenientes do edifício a reconverter, materiais prov incluídos.
32%	PRODUÇÃO ALIMENTAR	2%	S	Produção local de alimentos	C15	Produzir alimentos vegetais e/ou animais em áreas pertencentes a envolvente do edifício ou no próprio edifício (cobertura, varandas, entre outros). Percentagem de terreno livre cedido para fins agrícolas (terraços, logradouros, zonas de enquadramento).Utilização do edifico para fins agrícolas: coberturas, varandas, pisos, exemplo vertical farmer.	Determinar a produção local de alimentos vegetais (cedidas no empreendimento para a produção de alin
CARGAS AMBIENTAIS	EFLUENTES	3%	S	Tratamento das águas residuais	C16	Tratamento de águas efectuado no local. Edifício/zona não ligada ao sistema municipal de tratamento. Verificar se está ou não conectado ao sistema municipal de tratamento já que todas as águas são tratadas no local (ou tratamento parcial consoante situação), sendo que o nível será sempre o mínimo exigível consoante a sua reutilização.	Determinar o caudal de efluentes produzidos em litro e o nível de tratamento de cada fracção dos efluente
				Caudal de reutilização de águas usadas	C17	Utilização de água reutilizada para a manutenção de zonas verdes através de sistemas de rega automatizados e reutilização das águas cinzentas (50 %).	Determinar o caudal de reutilização de águas residu
	EMISSÕES ATMOSFÉRICAS	2%	S	Caudal de emissões atmosféricas - Partículas e/ou substâncias com potencial acidificante (Emissão de outros poluentes: SO2 e NOx)	C18	Possíveis medidas para a redução de emissões de SO2, NOx e partículas: eliminação ou diminuição dos equipamentos que funcionem com combustão (aquecedores de querosene, lareiras, com bilhas, etc.), fogões, esquentadores, caldeiras, fumo do tabaco, veículos estacionados no interior do edifício (estacionamento), entre outras.	Determinar quais as emissões de partículas, SO2, N de cálculo ou através de medidas implementadas pa
	RESÍDUOS	3%	S	Produção de resíduos	C19	Reduções na produção de resíduos sólidos (50% face à prática comum), e possibilidade de compostagem de resíduos orgânicos.	Determinar a produção em kg/hab.ano (ou equivalen
				Gestão de resíduos perigosos	C20	Reduzir e gerir os resíduos perigosos produzidos e utilizados e dos materiais e produtos que os originam e as medidas aplicadas com vista à sua redução. Medidas: eliminação, gestão e deposição final adequada e segura. Eliminação de pesticidas ou semelhantes, eliminação de cloro para as piscinas, locais para a arrumação segura e adequada das embalagens de limpeza e manutenção, existência de locais: para a deposição de pilhas, para a deposição de lâmpadas, para a deposição de óleos alimentares, para a deposição de resíduos perigosos de escritório (tinteiros). Eliminação de materiais perigosos existentes nos produtos usados para a manutenção e operação, bem como a existência de um plano de gestão e monitorização de resíduos perigosos.	Elaborar uma listagem dos resíduos perigosos produ deposição final adequada e segura. Esta listagem po urbanos.
				Valorização de resíduos	C21	Aumentar a quantidade, em kg ou equivalente, de resíduos reciclados no edifício.	Determinar a quantidade (kg ou equivalente) de resí
8 Critérios	RUÍDO EXTERIOR	3%	S	Fontes de ruído para o exterior	C22	Implementar soluções para reduzir as emissões de ruído para o exterior: equipamentos no interior silenciosos (potência sonora inferior a 50dB); equipamentos no exterior silenciosos (potência sonora inferior a 50dB); elementos de redução de ruído nos equipamentos; localização adequada de equipamentos que produzam ruído; deflectores que reduzam a propagação do som; colocação de isolamentos adequados nas paredes interiores ou exteriores envolventes aos equipamentos que emitem ruídos.	Definir os níveis de ruído no exterior do edifício prov seu interior ou Procedendo a medições ou Elaboran
12%	POLUIÇÃO ILUMINO-TÉRMICA	1%	S	Poluição ilumino-térmica	C23	Reduzir efeito de ilha de calor e de iluminação. Possíveis boas práticas a implementar: colocação de sombras sobre as áreas impermeáveis e/ou escuras; utilização de cores claras no exterior do edifício: fachadas, coberturas e/ou telhado, passeios e vias, utilização de vegetação sobre as coberturas, minimização das superfícies impermeáveis: das vias, passeios e parques de estacionamento exteriores, existência de estacionamento subterrâneo, utilização de vegetação nas áreas exteriores, superfícies com água, quantificação da intensidade de iluminação de zonas de publicidade e da arquitectura.	Elaborar uma listagem com as intervenções impleme

da (1/2)

	Possibilidade de Intervenção				
	E- Essencial	M -Muito Importante	I- Importante	R -Reduzida	S- Quase sem Importância

	ENTIDADES				
	E- Essencial	M -Muito Importante	I- Importante	R -Reduzida	S- Quase sem Importância

TÁVEL	APLICABILIDADE EM FUNÇÃO DA FASE				NÍVEL DE ACÇÃO DAS ENTIDADES				
COMO MEDIR	NºC	Plano	Projecto	Construção / Renovação	Operação	Licenciador	Promotor	Projectista	Construtor	Utilizador
s consideradas relevantes (sensíveis ecológicas ou degradadas (construídas/contaminadas)) para a avaliação (em m^2) antes da o. Averiguar as restrições do PDM. Estimar a percentagem das zonas valorizadas no local com a intervenção. Verificar quais as al (uso do solo, local de construção, etc.) e o que se pretende obter com cada uma delas concretamente ao nível de uso do solo.	C1	E	E	M	R	E	E	I	R	S
as e implantação, em m^2) para a avaliação, por edifício. Determinar a percentagem de área permeável do solo face à área total do lote	C2	E	E	M	R	E	M	E	R	S
tal do lote. Efectuar o levantamento local do número de espécies (vegetais ou animais) existentes e/ou adaptadas (que ão. Determinar % das áreas de vegetação natural e autóctones.	C3	E	E	M	I	M	E	E	R	I
do a promover relações entre espécies. Identificar as situações que possibilitam a interligação de habitats no lote (nomeadamente erde). Verificar se a estrutura verde do lote/empreendimento estabelece a continuidade com os corredores verdes envolventes o perímetro verde de contacto com os limites do lote. Verificar a existência de barreiras/obstáculos físicos entre habitats ou no mesmo	C4	E	E	M	I	I	R	E	R	I
roceder a uma listagem dos elementos que contribuem para a inserção e adaptação do edifício, face ao local, nomeadamente: forma e estética do edificado. Fazer uma análise crítica da volumetria da construção em comparação com as volumetrias existentes as na construção tendo em conta as que são utilizadas no local. Observar o tipo de construção da região estabelecendo uma análise	C5	R	E	M	I	E	I	E	I	R
ficado contribuem para conservação e valorização do património envolvente.	C6	E	E	M	R	E	M	E	M	I
mprimento da directiva comunitária da certificação energética SCE - Sistema Nacional de Certificação Energética e da Qualidade do Ar cionados com os níveis de eficiência energética.	C7	R	M	I	E	E	M	E	R	S
o provenientes exclusivamente de medidas bioclimáticas e de desempenho solar passivo. Listar todas as medidas implementadas	C8	E	E	I	E	R	I	E	E	I
CO2 (e/ou outros poluentes que contribuem para o efeito de estufa) a partir de fontes de energia renováveis e quantidade de energia (electrodomésticos, lâmpadas...) existentes, qual a sua classificação de eficiência energética, estabelecendo percentagens para cada omassa; Eólicos.	C9	R	E	M	E	S	M	E	I	R
ia (ou equivalente), pela leitura dos consumos provenientes de furo, da rede pública, ou da extracção de um corpo de água superficial cedendo a simulações computorizadas dos consumos efectuados. Elaborar uma inventariação das medidas implementadas que visam	C10	R	M	E	I	S	R	E	M	I
e após a intervenção e elaborar uma lista das medidas implementadas com vista à redução das escorrências e gestão das águas	C11	R	E	M	E	S	R	E	E	I
dos acabamentos e materiais utilizados no edifício face à prática comum, medindo o seu tempo de vida. Listar as medidas que nativas em detrimento de outras, de utilização comum, que iriam aumentar esse consumo. Estabelecer prazos em termos de tempo de	C12	M	E	I	I	S	R	E	E	R
nte) de materiais que foram adquiridos, manufacturados ou produzidos a uma distância inferior ou igual a 100 km do local da total utilizado.	C13	S	M	M	I	S	R	E	E	R
g ou equivalente) que possuem certificados ambientais e que sejam de baixo impacte, materiais reciclados e renováveis não venientes do próprio edifício a reconverter, estipulando a sua percentagem face ao total utilizado, ou lista de materiais nocivos não	C14	R	E	E	I	S	R	E	E	R
grau e diversidade) e pontualmente a produção local de alimentos animais (grau e diversidade). Verificar a percentagem de áreas nentos.	C15	R	E	M	E	R	I	E	I	E
s/hab.dia (ou equivalente) e apurar a quantidade que é tratada no local (requisitos técnicos da capacidade do sistema de tratamento) es procedendo a simulações computorizadas dos efluentes produzidos em litros/hab.dia (ou equivalente).	C16	I	E	M	M	I	R	E	I	R
ais tratadas (em litros/hab.dia), % do total, ou equivalente.	C17	I	E	I	E	S	S	E	M	I
Ox (e/ou outros poluentes que contribuem para o efeito de estufa) em kg/m^2.ano (ou equivalente) através de métodos ou simuladores ra a redução destas emissões e sua eficiência OU através da realização de monitorização.	C18	S	I	I	E	S	S	E	M	E
te) de resíduos sólidos urbanos.	C19	R	I	M	E	S	S	I	M	E
zidos e utilizados e dos materiais e produtos que os originam e as medidas aplicadas com vista à sua redução, eliminação, gestão e de ser o resultado da execução de um questionário aos moradores, realização de amostragens aleatórias nos resíduos sólidos	C20	S	I	M	E	S	S	I	E	E
duos reciclados no edifício (ou empreendimento).	C21	R	M	M	E	S	R	E	M	I
enientes do seu interior, em dB(A): utilizando as características sonoras dos equipamentos, edifício e actividades desenvolvidas no do um estudo de opinião da comunidade envolvente ou Listando medidas implementadas, seu objectivo, eficiência e eficácia.	C22	R	M	M	E	S	S	E	M	E
ntadas para a redução do efeito de ilha de calor e luminoso, com a sua relevância e eficiência.	C23	M	E	R	I	S	R	E	M	S

Essencial	Muito Importante	Importante	Reduzida	Quase sem Importância

Quadro 1 - Sistema LiderA, orientações e aplicação em cada fase do

NIVEL 1 **LIDERA 2.00** d1 **LIDERA SISTEMA DE AVALIAÇÃO DA SUSTENTABILIDADE - CRITÉRIOS PARA A CONSTRUÇÃO SUSTEN**

VERTENTE	ÁREA	Wi	Pre-Req.	CRITÉRIO	NºC	LINHAS DE BOA PRÁTICA	
CONFORTO AMBIENTAL	QUALIDADE DO AR	5%	S	Níveis de qualidade do ar	C24	Fomentar a ventilação natural, o seu tipo e incidência por divisão; Promover medidas implementadas com vista à redução de COVs (se existirem materiais, carpetes, isolantes entre outros, que poderão ser fontes de COV) e redução de contaminações no ar interior (micro-contaminações)	Estipular o caudal ou taxa de ventilação existente no tipo de uso do edifício (exemplo: para habitação não acabamentos existentes que poderão ser fontes de C efectivas no interior: Realizar uma monitorização par
	CONFORTO TÉRMICO	5%	S	Conforto térmico	C25	Atingir os níveis de conforto térmico estabelecidos de forma passiva: humidade (35% e 60%), temperatura (18º a 26º, adaptando o nível mínimo de 18º no inverno e o nível máximo de 26º no verão, ou seja: devendo a sua variação sazonal corresponder à variação sazonal da temperatura do ar exterior), velocidade do ar (inverno ≤ 0,2 m/s e no verão ≤ 0,5 m/s). Assegurar boas condições de conforto nas zonas utilizadas exteriores, por exemplo sombras, protecções ao vento.	Determinar os níveis de temperatura (ºC ou equivale monitorização, parâmetros de controlo, SGA ou simu Efectuar-se um levantamento de todas as medidas q
4 Critérios	ILUMINAÇÃO E ACÚSTICA	5%	S	Níveis de iluminação	C26	Níveis de iluminação de acordo com os definidos pelo CIBSE, para as diferentes áreas e segundo a actividade desenvolvida (interior à volta dos 350 a 400 lux).	Determinar os níveis de iluminação (lux) nas áreas p espacial das armaduras, tipo de lâmpadas; e as cond exterior e verificar os níveis de iluminação.
15%				Conforto sonoro	C27	Definir os níveis de ruído no interior do edifício em dB(A): através da caracterização das características sonoras dos equipamentos, as suas especificações técnicas de isolamento e dos envidraçados do edifício, tendo em consideração as actividades desenvolvidas no seu interior; Verificar o tipo de isolamentos, caixilharia, vidros e outras soluções construtivas aplicadas no edifício e o seu desempenho; Efectuar um inquérito junto dos ocupantes onde se ateste o incómodo sonoro no interior do edifício.	Determinação do nível de ruído em dBA em cada áre
VIVÊNCIA SOCIOECONÓMICA	ACESSO PARA TODOS	5%	S	Acesso aos transportes Públicos	C28	Acesso a transportes públicos ou criação de acesso a nós de transportes públicos, em casos específicos criação de mecanismos de transporte públicos próprios e distância aos mesmos.	Determinar o número de transportes públicos e a res menos de 500 m e os que se situam entre 500 e 100 isoladamente ou estão integrados em nós de transpo
				Mobilidade de baixo impacte	C29	Promover soluções de mobilidade de baixo impacte passíveis de serem implementadas, como por exemplo: Percursos pedonais, junto ao edifício ou edifícios, com dimensões adequadas ao fluxo de pessoas que, porventura, realizarão diariamente esse trajecto; Ciclovias, parqueamento de bicicletas e balneáreos afectos ao parqueamento de bicicletas; Poolshare de Carros, Carros Híbridos ou a Combustíveis ecológicos (eléctricos, biodiesel, hidrogénio, etc); Lugares de estacionamento para veículos ecológicos; posto de carregamento de veículos eléctricos; Serviços de transfers locais ou de Mini-Bus.	Verificar as condições dos caminhos pedonais, garar Medir as distâncias até às ciclovias mais próximas (r seus elementos de apoio (duches, parqueamento pa -Serviços para Carpooling, Carros Híbridos ou de Co -Serviços de transfers -Existência de lugares de estacionamento reservado -Postos de carregamento para veículos eléctricos
				Soluções inclusivas	C30	Reduzir os locais com potenciais problemas de acessibilidade e movimentação e identificar as soluções inclusivas adoptadas com vista à sua resolução, quer no interior das habitações quer no exterior.	Identificar as soluções inclusivas adoptadas e sua ab sinalética que esclareça o modo de funcionamento d acessibilidade (elevadores, rampas…).
	DIVERSIDADE ECONÓMICA	4%	S	Flexibilidade - Adaptabilidade aos usos	C31	Fomentar a flexibilidade dos espaços, nomeadamente através da existência de áreas modulares e adaptáveis a várias utilizações.	Verificar a existência de diferentes tipologias habitac desenhadas do projecto de maneira a determinar zo estão concentradas e são de fácil acesso; Verificar a
				Dinâmica económica	C32	Criar condições para potenciar e incentivar as actividades económicas locais. Reduzir as desigualdades sociais ao nível local, identificando e adaptando soluções com vista à sua resolução. Fomentar a fixação de actividades económicas relevantes para o desenvolvimento da zona.	Na frente de rua: Quantificar a percentagem de frente de rua destinada No edifício e restantes áreas do lote: Quantificar a capacidade de rentabilização através d mercado); Verificar as condições de arrendamento (p social" na malha urbana
				Trabalho local	C33	Criar condições para gerar novos empregos no edificado e/ou existência de postos de trabalho na envolvente do mesmo (até 1000 m) que possam contribuir para a integração social das pessoas que residam nesse edifício. Não deve existir decréscimo no número de empregos permanentes. Deve-se fomentar a oferta de emprego nas actividades para o espaço público: comerciais, culturais, actividades locais, criação de empregos de elevada competência que contribua para o desenvolvimento da região onde se insere.	Conjugação entre valores dos postos de trabalho e n construção por cada posto de trabalho. Contabilizar
	AMENIDADES E INTERACÇÃO SOCIAL	4%	S	Amenidades locais	C34	Existência de amenidades naturais (rio, bosque), humanas como lojas de comida e correios a 500 m. Proximidade a cinco das seguintes amenidades a 1000 m: posto dos correios, banco, farmácia, escola, centro de saúde, centro de lazer, centro comunitário, jardim para crianças.	Quantificar as amenidades naturais e humanas exist segundo um percurso que possa ser facilmente perc
				Interacção com a comunidade	C35	Intervenções que permitam a integração e acessibilidade da comunidade ao empreendimento: tornar possível que não residentes do edifício possam usufruir dos espaços exteriores naturais de lazer e/ou desporto, destinados a qualquer faixa etária. Privilegia-se também em certas situações o usufruto das zonas interiores do edifício que possam ser acedidas pela comunidade (ex: zonas interiores de restauração associadas aos espacos exteriores públicos), zonas de interaccão comunitária.	Identificar todas as soluções, equipamentos, activida
	PARTICIPAÇÃO E CONTROLO	4%	S	Capacidade de controlo	C36	Fundamentar a controlabilidade ao nível de conforto em 5 grandes áreas: Temperatura, Humidade, Ventilação, Sombreamento e Iluminação. Devem-se procurar soluções que possam abranger todas essas áreas e que promovam a interacção entre as mesmas, resultando num melhor comportamento do conjunto edificado e numa maior eficácia na obtenção dos níveis de conforto adequados para os utentes.	Quantificar as medidas que visam dotar os utentes d
				Condições de participação e governância	C37	Promover na fase inicial do plano estratégico uma troca alargada de informação entre os responsáveis pelo projecto e os eventuais utilizadores do espaço. Promover reuniões periódicas em cada fase do projecto, onde os possíveis utilizadores estejam representados por uma população diversificada (idade, nível de instrução, condição económica). Definir uma equipa de projecto organizada hierarquicamente com funções bem definidas e estipuladas para cada um dos seus membros. As decisões tomadas pela equipa de projecto devem ser sempre divulgadas a população local antes de se iniciar qualquer intervenção no espaço público. Criar condições e implementar medidas que permitam uma boa interacção com a comunidade, e que essa mesma comunidade (nomeadamente a residente) tenha influência nas tomadas de decisão relativamente à gestão do edificado e sua evolução.	Averiguar a capacidade de interacção entre a equipe Verificar a existência de mecanismos de participação operação do edificado.
				Controlo dos riscos naturais - (Safety)	C38	Adequar a intervenção aos riscos naturais existentes e evitar os riscos inerentes às soluções arquitectónicas adoptadas. A possibilidade de ocorrer algum acidente involuntário natural deve ser reduzido, pelo que se deve ter particular atenção durante a fase de planeamento e construção do edifício para evitar a construção ou aplicação de elementos potencialmente perigosos, ou que não sejam suficientes para evitar ou inibir as consequências de ameaças naturais. Medidas a implementar: implementação de estruturas de protecção/resistentes a sismos, ventos fortes, cheias e outros riscos naturais nos locais com médio ou elevado grau de perigo para o utente. Por exemplo: implementação de bons revestimentos no exterior do edifício e que sejam resistentes às condições climatéricas extremas, incorporação de vidros temperados nos edifícios ou no mobiliário urbano que se encontra parcialmente ou totalmente exposto ao clima ou com grande afluência ou passagem de pessoas entre outras.	Quantificação da utilização de materiais e soluções a utilizadores. Estimar quais são as áreas e níveis de r planeamento e construção do edifício e zonas exterio
13 Critérios				Controlo das ameaças humanas - (Security)	C39	Aplicação de medidas de controlo e inibição da criminalidade e vandalismo em duas vertentes distintas mas complementares: edifício e espaço público adjacente, sendo que as medidas ao nível do espaço público são as mais preponderantes. Essas medidas podem-se organizar em áreas referentes à iluminação, vigilância, permeabilidade do espaço e campos de visão nesse mesmo espaço. Medidas a implementar: controlo dos riscos associados a actividades que utilizem substâncias perigosas. Existência de espaços bem iluminados, vigiados e com campo de visão aberto, edifícios com fachada e acesso principal inserido na frente/rua, estabelecimento de horário de abertura/encerramento em áreas cuja segurança/criminalidade seja difícil de controlar, pátios interiores.	Efectuar o levantamento de medidas que visem a red criminalidade e vandalismo em duas vertentes distint preponderantes. Essas medidas podem-se organiza
19%	CUSTOS NO CICLO DE VIDA	2%	S	Custos no ciclo de vida	C40	Fomentar uma boa relação custo/qualidade dos materiais, equipamentos, sistemas, elementos existentes no edifício. Apostando em: Sistemas eficientes e de baixo custo na energia e água; Escolha adequada de materiais duráveis e resistentes com elevado tempo de vida útil; Uso de materiais com alto aproveitamento na reciclagem (alumínio, ferro e madeira); Correcta aplicação dos materiais de acordo com as suas durabilidades e com as exigências a que estão submetidos; Selecção de materiais e sistemas de fácil manutenção; Custos e periodicidade da manutenção.	Verificar a relação custo/qualidade dos equipamento Quantificar os custos de manutenção/operação refer Analisar os encargos que possam decorrer através d Medição dos materiais utilizados que tenham alto ap
USO SUSTENTÁVEL	GESTÃO AMBIENTAL	6%	S	Condições de utilização ambiental	C41	Disponibilizar informação ambiental e modos de utilização do edificado, e do espaço exterior que facilitem a correcta utilização e o bom desempenho do empreendimento. Informações: manual de utilizador, plantas de instalações eléctricas, canalizações, arquitectónicas, informação sobre utilização e manutenção de equipamentos, estrutura, materiais, entre outras. Informação sobre monitorizações e desempenho, entre outras.	Identificar todos os tipos (em qualidade e quantidade de equipamentos, plantas do edifício, especificações Deve-se analisar se a quantidade de informação disp
3 Critérios				Sistema de gestão ambiental	C42	Implementar modos de gestão ambiental documentados. Fomentar a procurar de objectivos de gestão ambiental que procurem a sustentabilidade. Se possível implementar um sistemas de gestão ambiental, e proceder à sua certificação pela ISO 14001 ou EMAS.	Verificar e listar a existência de algum tipo de monito
8%	INOVAÇÃO	2%	S	Inovações	C43	Sistematizar e analisar as inovações estruturais ou pontuais que tenham uma contribuição efectiva e eficaz para um ou mais critérios de avaliação, contribuindo eficazmente para a melhoria do desempenho ambiental do edifício, com possibilidade de afectar também a área de incidência. Verificar-se a existência de um elemento inovador em, pelo menos, 2 das seguintes vertentes (integração local, recursos, cargas e vivência socio-económica).	Listar os aspectos inovadores que foram implementa edifício e a área de incidência. As inovações contabil essas contribuições se enquadram no âmbito da con

o ciclo de vida (2/2)

E- Essencial	M -Muito Importante	I- Importante	R -Reduzida	S- Quase sem Importância

TÁVEL

APLICABILIDADE EM FUNÇÃO DA FASE

NÍVEL DE ACÇÃO DAS ENTIDADES

COMO MEDIR	NºC	Plano	Projecto	Construção / Renovação	Operação	Licenciador	Promotor	Projectista	Construtor	Utilizador
interior; Verificar a existência de ventilação natural, o seu tipo e incidência por divisão; Determinar a taxa de ventilação consoante o poder ser < 0.6% e para terciário < 0.8%); Efectuar um levantamento para determinar o tipo de materiais, carpetes, isolantes e/ou COV's e apresentar uma listagem das medidas implementadas com vista à sua redução; Realizar uma monitorização das emissões a determinar a concentração dos diversos poluentes micro contaminantes no ar interior e exterior.	C24	S	E	M	E	I	R	E	I	E
nte), humidade (em %) e velocidade do ar (m/s ou equivalente) que se registam no interior, ao longo do ano através de: lação; Determinar a satisfação dos ocupantes relativamente ao conforto térmico interior, através da realização de um inquérito; ue foram adoptadas com vista a garantir boas condições de conforto interior.	C25	I	E	R	E	I	R	E	M	E
rincipais e secundárias; Verificar o tipo de sistemas de iluminação existentes no edifício tais como: a organização e distribuição dições do espaço a iluminar: dimensão, forma, cor, etc.; Sistematizar as principais actividades humanas e naturais nos espaços	C26	R	M	R	E	R	S	E	M	E
ea principal ocupada. Definir os valores para cada limiar consoante os valores exigidos no Regulamento Geral do Ruído.	C27	R	E	R	M	R	S	E	I	E
spectiva distância a que se encontram do local. Utilizar duas bitolas de medição para o efeito, determinando aqueles que se situam a 00 m; Averiguar a frequência (periodicidade) dos transportes identificados; Verificar se os transportes públicos identificados operam orte público (esta última situação é privilegiada em termos de limiares).	C28	E	M	I	E	S	E	M	R	I
ntindo a sua boa acessibilidade, as condições dos locais onde se inserem (passeios) e os atravessamentos com as restantes vias; aio de 100 m como valor de referência dos limiares) e verificar o seu correcto dimensionamento e funcionamento, identificando os ra bicicletas, condições de aluguer…); Identificar as condições para a prática de outros tipos de mobilidade de baixo impacte: mbustíveis ecológicos s para veículos ecológicos	C29	E	M	I	E	S	I	M	R	E
orangência, quer no interior das suas habitações ou instalações, quer nos espaços comuns e exteriores; Verificar a existência de os espaços e dos mecanismos; Identificar as medidas construtivas que possibilitem uma futura integração de elementos de	C30	M	E	I	E	I	I	E	M	E
ionais e a composição das paredes interiores das mesmas (privilegiam-se as paredes móveis ou de fácil remoção); Analisar as peças nas de duplo pé direito, ou pé-direito elevado; Através dos desenhos/ memória descritiva das especialidades, verificar se as tubagens a pré existência de instalações mecânicas (nomeadamente para climatização, equipamentos de energia renovável e electrónicos).	C32	R	E	R	M	R	I	E	M	E
a a actividades comerciais; Identificar o tipo de comércio (definitivo ou temporário). e aluguer de espaços e receitas provenientes das energias renováveis; Averiguar a diversidade de tipologias (melhor adaptação ao rivilegia-se a diversidade de valores para as várias classe sociais e faixas etárias); Analisar a integração dos edifícios de "habitação	C32	E	R	R	E	I	E	M	R	M
º de intervenções. Tem que verificar simultaneamente as duas condições em cada patamar de avaliação; Quantificar a área bruta de os empregos gerados pelo próprio edifício; Verificar a existência de empregos na envolvente (até 100 m).	C33	E	I	R	E	I	E	M	R	E
entes na envolvente do edifício ou empreendimento (raio de 1000 m). Determinar a distância a cada uma dessas amenidades, orrível a pé.	C34	M	I	R	E	S	I	I	R	M
des e medidas adoptados com vista a garantir a acessibilidade e interacção do espaço edificado com a comunidade envolvente.	C35	E	M	R	E	S	M	I	R	E
e capacidade de controlo, abrangência e programabilidade, tanto ao nível dos espaços interiores como dos espaços exteriores.	C36	R	E	I	E	S	I	M	R	E
projectista e dono de obra com os utentes durante as fases de projecto e construção. o e governância implementados após a fase de construção, destinados a assegurar a interacção com os utentes durante a fase de	C36	S	I	I	E	S	E	I	S	E
rquitectónicas que não representem um risco ou que reduzam os efeitos dos riscos naturais (cheias, sismos, ventos fortes) para os redução das ocorrências de acidentes resultantes de fenómenos naturais, devendo ser dada particular atenção durante a fase de ores.	C37	S	E	E	E	I	M	E	E	I
dução de fenómenos de criminalidade e vandalismo no edifício e áreas adjacentes. Aplicação de medidas de controlo e inibição da das mas complementares: edifício e espaço público adjacente, sendo que as medidas ao nível do espaço público são as mais r em áreas referentes à iluminação, vigilância, permeabilidade do espaço e campos de visão nesse mesmo espaço.	C38	M	E	R	E	I	E	M	I	I
s e soluções. Sistematização de custos na construção euros /m2, % acréscimo das medidas. entes ao uso de materiais do edificado, assegurando a sua integridade durante todo o ciclo de vida do edifício. da prescrição do tipo de redes para águas e energia, através da sua manutenção associada. roveitamento na reciclagem.	C39	R	M	R	E	R	M	E	M	E
e) de informação disponíveis e entregues aos ocupantes e responsáveis da manutenção, sobre aspectos ambientais, funcionamento s de manutenção, monitorizações, manuais de utilização, instalações, entre outros. ponibilizada está de acordo com os destinatários (utentes/técnicos de manutenção) e se é clara e concisa.	C41	S	R	M	E	R	E	M	R	I
rização ambiental, SGA (ou outros), bem como as certificações existentes ou a existir e a fase em que se encontram.	C42	E	E	I	E	I	E	M	R	E
dos e proceder a uma caracterização dos mesmos, inclusive o seu contributo efectivo para a melhoria de desempenho ambiental do izadas deverão, impreterivelmente, ter uma contribuição efectiva para um ou mais critérios avaliados no LiderA, garantindo assim que strução sustentável.	C43	M	M	I	E	S	E	E	M	M

Essencial	Muito Importante	Importante	Reduzida	Quase sem Importância

SINGAPORE INDICATORS TARGET FOR 2030

	Indicator	2013 Levels	Target for 2030
	Green and Blue Spaces		
1	Amount of skyrise greenery	61 ha	200 ha
2	Amount of park space and water bodies open to recreational activity		Park Provision Ratio of 0.8 ha / 1,000 population
	a) Parks	4040 ha	
	b) Waterbodies	959 ha	1039 ha
3	Length of park connectors and waterways open to recreational activity		
	a) Park connectors	216 km	400 km
	b) Waterways	93 km	100 km
4	Length of Nature Ways	21 Km	180 km
5	Proportion of households within 10-min walk of a park	80%	90%
	Mobility		
6	Length of cycling paths	230 km	700 Km
7	Modal share of journeys during peak hours made via public transport	64%	75%
8	Length of rail network	180 km	360 km
9	Proportion of households within 10-min walk of a train station	58.5%	80%
	Resource Sustainability		
10	Proportion of buildings to achieve BCA Green Mark Certified rating	21,90%	80%
11	Energy intensity improvement (from 2005 levels)	22%	35%
12	Domestic water consumption per capita per day	151 L	140 L
13	National recycling rate	61%	70%
	a) Domestic recycling rate	20%	30%
	b) Non-domestic recycling rate	77%	81%

	Air Quality		
14	Air Quality		(Targets for 2020)
	a) PM2.5		
	Annual mean	20 µg/m3	12 µg/m3
	24-hour mean (99th percentile)	176 µg/m3	37.5 µg/m3
	b) PM10		
	Annual mean	31 µg/m3	20 µg/m3
	24-hour mean (99th percentile)	215 µg/m3	50 µg/m3
	c) Sulphur Dioxide (SO2), 24-hour mean (Max)	75 µg/m3	50 µg/m3
	d) Ozone, 8-hour mean (Max)	139 µg/m3	100 µg/m3
	e) Nitrogen Dioxide (NO2)		
	Annual mean	25 µg/m3	40 µg/m3
	1-hour mean (Max)	132 µg/m3	200 µg/m3
	f) Carbon Monoxide (CO)		
	8-hour mean (Max)	5.5 mg/m3	10 mg/m3
	1-hour mean (Max)	7.5 mg/m3	30 mg/m3
	Drainage		
15	Flood-prone areas	36 ha	23 ha
	Community Stewardship		
16	Number of active green volunteers	> 1000	5000
17	Number of Community in Bloom Gardens	>700	2000
18	Number of litter-free Bright Spots	>300	500

SSUP – SUSTAINABLE URBAN PLANNING EVALUATION SYSTEM

CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
ENVIRONMENTAL							
ENVIRONMENTAL HEALTH							
AIR	PM10 Concentration	-	-	1	0,6	-	
	SO2 Concentration	-	-	1	0,6	-	
	NO2 Concentration	-	-	1	0,6	-	
	Indoor Air Pollution	-	-	1	0,6	-	
WATER	Access to Urban Water	-	-	0,6	0,36	-	
	Access to Rural Water	-	-	0,4	0,24	-	
	Access to Drinking Water	-	-	1	0,6	-	
	Access to Sanitation	-	-	1	0,6	-	
WASTE	Municipal Waste Intensity	-	-	0,5	0,3	-	
	Industrial Solid Waste Intensity	-	-	0,5	0,3	-	
	Municipal Solid Waste Treated	-	-	0,3	0,18	-	
	Municipal Wastewater Treated	-	-	0,5	0,3	-	
	Urban Human Waste Disposal	-	-	0,3	0,18	-	
	Rural Human Waste Disposal	-	-	0,3	0,18	-	
	Efficience Reuse of Waste	-	-	0,3	0,18	-	
	Percentage of population with regular solid waste collection	-	-	0,3	0,18	-	
NOISE	Noise level in selected areas	-	-	0,5	0,3	-	
	Infrastructure Noise	-	-	0,5	0,3	-	
	Population exposed to high level noise	-	-	1	0,6	-	
POLLUTION	Light pollution reduction	-	-	1	0,6	-	
	Heavy Metals	-	-	1	0,6	-	
	Hazardous pollution	-	-	1	0,6	-	
	Atmospheric pollution	-	-	1	0,6	-	

CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
ECOSYSTEM VITALITY							
AIR	SO2 per Capita	-	-	0,9	0,54	-	
	NO2 per Capita	-	-	0,9	0,54	-	
WATER	Water provision	-	-	0,6	0,36	-	
	Marine Protected Areas	-	-	0,6	0,36	-	
	Freshwater Quality	-	-	1	0,6	-	
	Freshwater Resources	-	-	1	0,6	-	
BIODIVERSITY	Terrestrial Protected Areas	-	-	1	0,6	-	
	Critical Habitat Protection	-	-	0,5	0,3	-	
GREEN AREAS	Parks	-	-	0,5	0,3	-	
	Forest	-	-	0,5	0,3	-	
	Soil Erosion	-	-	0,7	0,42	-	
	Use of Chemical products in agricolture	-	-	0,5	0,3	-	
	Green area	-	-	0,8	0,48	-	
LAND MANAGEMENT	Population Density	-	-	0,75	0,45	-	
	Building Density	-	-	0,75	0,45	-	
	Infrastructure Density	-	-	0,5	0,3	-	
	Restoration of urban land	-	-	0,5	0,3	-	
	Reuse of contaminated land	-	-	0,5	0,3	-	
	Local food production	-	-	0,75	0,45	-	
	Smart Location	-	-	0,75	0,45	-	

CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
ECONOMIC SUSTAINABILITY							
CLIMATE CHANGE	Weather conditions	-	-	0,6	0,36	-	
	General pollution	-	-	0,6	0,36	-	
	Air emissions intensities	-	-	0,8	0,48	-	
ENERGY	Energy Access	-	-	1	0,6	-	
	Type of Energy	-	-	0,7	0,42	-	
	Infrastructure Enegy Efficiency	-	-	0,8	0,48	-	
	Production of not Renevables Electricity	-	-	0,7	0,42	-	
	Production of Renevables Electricity	-	-	1	0,6	-	
	Energy Supply	-	-	0,8	0,48	-	
	On-Site Energy Generation	-	-	1	0,6	-	
ENVIRONMENTAL GOVERNANCE	Investment in Environment Protection	-	-	0,45	0,27	-	
	Energy Incentives	-	-	0,55	0,33	-	
GREEN INFRASTRUCTURE AND BUILDINGS							
URBAN MORPHOLOGY	Diversity of Building Types	-	-	0,4	0,24	-	
	Average Heights of Buildings	-	-	0,4	0,24	-	
	Solar Orientation	-	-	0,6	0,36	-	
	Reuse of Historical Buildings	-	-	0,6	0,36	-	
	Green Transport	-	-	0,6	0,36	-	
	Walkable Street	-	-	0,6	0,36	-	
	Certified Green Buildings	-	-	0,4	0,24	-	
	Building Class	-	-	0,6	0,36	-	
	Traffic	-	-	0,6	0,36	-	
	Bicyle Network	-	-	0,6	0,36	-	
	Architectural Barriers	-	-	0,6	0,36	-	

CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
SOCIAL							
SMART SERVICES							
EDUCATION	Student/teacher ratio	-	-	0,5	0,3	-	
	Percentage of students completing primary education	-	-	0,5	0,3	-	
	Percentage of students completing secondary education	-	-	0,5	0,3	-	
	Number of education structures in a specific area	-	-	0,5	0,3	-	
HEALTH	Mortality	-	-	0,3	0,18	-	
	Birth Rate	-	-	0,3	0,18	-	
	Average life expectancy	-	-	0,3	0,18	-	
	Numbers of hospital beds per 100000 population	-	-	0,2	0,12	-	
	Prevalence of Tobacco use	-	-	0,2	0,12	-	
	Mortality of major disease	-	-	0,4	0,24	-	
	Number of health structures in a specific area	-	-	0,3	0,18	-	
SAFETY	Homicide rate	-	-	0,4	0,24	-	
	Security force	-	-	0,4	0,24	-	
	Crime rate	-	-	0,4	0,24	-	
	Number of safety structures in a specific area	-	-	0,3	0,18	-	

CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
FIRE & EMERGENCIES	Firefighting rate	-	-	0,4	0,24	-	
	Response time for fire department from initial call	-	-	0,4	0,24	-	
	Death due fire	-	-	0,4	0,24	-	
	Number of fire & emergencies structures in a specific area	-	-	0,3	0,18	-	
TRANSPORTATION	High capacity public transit system	-	-	0,45	0,27	-	
	Light passenger transit system	-	-	0,45	0,27	-	
	Personal automobiles	-	-	0,3	0,18	-	
	Diversification of transport system	-	-	0,3	0,18	-	
	Eco-Friendly transport system	-	-	0,3	0,18	-	
	Mode of transportation used by children to travel between home and school	-	-	0,45	0,27	-	
	Mode of transportation used by workers to travel between home and workplace	-	-	0,3	0,18	-	
	Reduced Mobility	-	-	0,45	0,27	-	
HOUSING	Total number of households	-	-	0,3	0,18	-	
	Housing	-	-	0,2	0,12	-	
	Persons per unit	-	-	0,3	0,18	-	
	Dwelling density (per Square Kilometer)	-	-	0,2	0,12	-	
	Durable structures	-	-	0,2	0,12	-	
	Affordable rental housing	-	-	0,3	0,18	-	
	Affordable for sale housing	-	-	0,2	0,12	-	
	Slums	-	-	0,3	0,18	-	
	Authorized housing	-	-	0,2	0,12	-	
	Evictions	-	-	0,2	0,12	-	
	Poor households	-	-	0,3	0,18	-	
	Secure tenure	-	-	0,3	0,18	-	

CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
CULTURE	Structures	-	-	0,7	0,42	-	
	Investments	-	-	0,4	0,24	-	
	Events	-	-	0,4	0,24	-	
RECREATION	Indoor recreation facilities	-	-	0,6	0,36	-	
	Outdoor recreation facilities	-	-	0,6	0,36	-	
	City investments	-	-	0,3	0,18	-	
NATURAL HAZARDS	Hazard prone areas	-	-	0,5	0,3	-	
	Human and economic loss due to natural disasters	-	-	0,7	0,42	-	
	Disaster prevention	-	-	0,4	0,24	-	
	Risk management	-	-	0,4	0,24	-	
INNOVATION	University	-	-	1,2	0,72	-	
	Incentives for use eco-friendly technologies	-	-	0,8	0,48	-	
SOCIAL EQUITY							
POPULATION	Children	-	-	0,7	0,42	-	
	Teenagers	-	-	0,7	0,42	-	
	Adults	-	-	0,7	0,42	-	
	Senior citezens	-	-	1	0,6	-	
	Male and female population	-	-	0,7	0,42	-	
	Annual population change	-	-	1	0,6	-	
	Foreign population	-	-	0,7	0,42	-	
	Immigrants	-	-	0,7	0,42	-	
	Internal migration	-	-	1	0,6	-	
	Integration	-	-	0,7	0,42	-	
POVERTY	Population in poverty	-	-	0,8	0,48	-	
	Homeless people	-	-	0,6	0,36	-	
	Income inequality	-	-	0,6	0,36	-	

CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
ECONOMY							
SUSTAINABLE SOCIETY							
ECONOMIC DEVELOPMENT	Cost of living	-	-	0,8	0,48	-	
	Total employment	-	-	0,8	0,48	-	
	Rate of women in employment	-	-	0,5	0,3	-	
	Percentage of persons in full time employment	-	-	0,6	0,36	-	
	Number of Businesses per 1000 Population	-	-	0,5	0,3	-	
	Annual average unemployment rate	-	-	0,5	0,3	-	
	Information and communication technologies	-	-	0,5	0,3	-	
	Research and development	-	-	0,5	0,3	-	
	Tourism	-	-	0,5	0,3	-	
	Inflation Rate	-	-	0,8	0,48	-	

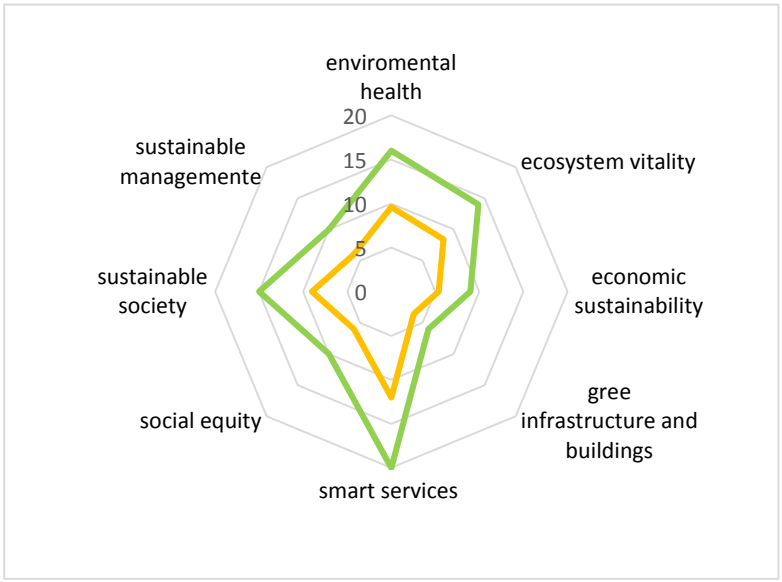
CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
FINANCE	Debt service ratio	-	-	0,8	0,48	-	
	Tax collected as percentage of tax billed	-	-	0,7	0,42	-	
	Own-source revenue as a percent of total revenues	-	-	0,7	0,42	-	
	Capital spending as percentage of total expenditures	-	-	0,6	0,36	-	
	Private investiment in public sustaintability projects	-	-	1,25	0,75	-	
	Public investiment in public sustaintability projects	-	-	1,25	0,75	-	
RESOURCES	Price of water	-	-	1	0,6	-	
	Price of energy	-	-	1	0,6	-	
	Price of land in urban area	-	-	0,5	0,3	-	
	Price of land in rural area	-	-	0,5	0,3	-	
	Price of materials	-	-	1	0,6	-	

CATEGORY	INDICATORS	DATA	UNITS	AVAIBLE POINTS	AVERAGE POINTS	RESULT	EVALUATION
GOVERNANCE							
SUSTAINABLE MANAGEMENT							
GOVERNMENT	Type of government (e.g. Local, Regional, County)	-	-	1,1	0,66	-	
	Gross operating budget	-	-	1,1	0,66	-	
	Gross capital budget	-	-	0,7	0,42	-	
	Women in the goverment	-	-	1,1	0,66	-	
PARTECIPATION	Civic associations	-	-	0,5	0,3	-	
	Citiziens partecipation	-	-	0,5	0,3	-	
EFFICENCY	Corruption	-	-	1,2	0,72	-	
	Bribes	-	-	0,8	0,48	-	
	Competitive Index	-	-	1,2	0,72	-	
	Enviromental and social management	-	-	1,2	0,72	-	
	Rate of incentives for eco-friendly procedures	-	-	0,8	0,48	-	

SYSTEM of SUSTAINABLE URBAN PLANNING

EVALUATION CERTIFICATION

INDICATORS	USED	SCORE
ENVIRONMENTAL		
Enviromental Health		
Ecosystem Vitality		
Economic Sustainability		
Gree Infrastructure and Buildings		
SOCIAL		
Smart Services		
Social Equity		
ECONOMY		
Sustainable Society		
GOVERNANCE		
Sustainable Managemente		
TOTAL		



CERTIFICATION

Average Points

Avaiable Points

SSUP – SUSTAINABLE URBAN PLANNING MONITORING SYSTEM

CATEGORY		INDICATOR		PROJECT DATA	PROJECTPOINTS	AVERAGE POINTS	ACTUAL DATA	ACTUAL POINTS	EVALUATION
ENVIRONMENTAL									
ENVIRONMENTAL HEALTH									
EN-H 1	AIR	EN-H 1-1	PM10 Concentration	-	-	0,6	-	-	
		EN-H 1-2	SO2 Concentration	-	-	0,6	-	-	
		EN-H 1-3	NO2 Concentration	-	-	0,6	-	-	
		EN-H 1-4	Indoor Air Pollution	-	-	0,6	-	-	
EN-H 2	WATER	EN-H 2-3	Access to Drinking Water	-	-	0,6	-	-	
		EN-H 2-4	Access to Sanitation	-	-	0,6	-	-	
EN-H 3	WASTE	EN-H 3-1	Municipal Waste Intensity	-	-	0,3	-	-	
		EN-H 3-2	Industrial Solid Waste Intensity	-	-	0,3	-	-	
		EN-H 3-4	Municipal Wastewater Treated	-	-	0,3	-	-	
EN-H 4	NOISE	EN-H 4-3	Population exposed to long-term high level noise	-	-	0,6	-	-	
EN-H 5	POLLUTION	EN-H 5-1	Light pollution reduction	-	-	0,6	-	-	
		EN-H 5-2	Heavy Metals	-	-	0,6	-	-	
		EN-H 5-3	Hazardous pollution	-	-	0,6	-	-	
		EN-H 5-4	Atmospheric pollution	-	-	0,6	-	-	
ECOSYSTEM VITALITY									
EC-V 2	WATER	EC-V 2-3	Freshwater Quality	-	-	0,6	-	-	
		EC-V 2-4	Freshwater Resources	-	-	0,6	-	-	
EC-V 3	BIODIVERSITY	EC-V 3-1	Terrestrial Protected Areas	-	-	0,6	-	-	
EC-V 4	GREEN AREAS	EC-V 4-3	Soil Erosion	-	-	0,42	-	-	
		EC-V 4-5	Green area	-	-	0,48	-	-	
EC-V 5	LAND MANAGEMENT	EC-V 5-1	Population Density	-	-	0,45	-	-	
		EC-V 5-2	Building Density	-	-	0,45	-	-	
		EC-V 5-6	Local food production	-	-	0,45	-	-	
		EC-V 5-7	Smart Location	-	-	0,45	-	-	

CATEGORY		INDICATOR		PROJECT DATA	PROJECTPOINTS	AVERAGE POINTS	ACTUAL DATA	ACTUAL POINTS	EVALUATION
ECONOMIC SUSTAINABILITY									
EC-S 1	CLIMATE CHANGE	EC-S 1-1	Weather conditions	-	-	0,36	-	-	
		EC-S 1-2	General pollution	-	-	0,36	-	-	
		EC-S 1-3	Air emissions intensities	-	-	0,48	-	-	
EC-S 2	ENERGY	EC-S 2-1	Energy Access	-	-	0,6	-	-	
		EC-S 2-5	Production of Renevables Electricity	-	-	0,6	-	-	
		EC-S 2-7	On-Site Energy Generation	-	-	0,6	-	-	
GREEN INFRASTRUCTURE AND BUILDINGS									
GI-B 1	URBAN MORPHOLOGY	GI-B 1-3	Solar Orientation	-	-	0,36	-	-	
		GI-B 1-4	Reuse of Historical Buildings	-	-	0,36	-	-	
		GI-B 1-5	Green Transport	-	-	0,36	-	-	
		GI-B 1-6	Walkable Street	-	-	0,36	-	-	
		GI-B 1-8	Building Class	-	-	0,36	-	-	
		GI-B 1-9	Traffic	-	-	0,36	-	-	
		GI-B 1-10	Bicyle Network	-	-	0,36	-	-	
		GI-B 1-11	Architectural Barriers	-	-	0,36	-	-	

CATEGORY		INDICATOR		PROJECT DATA	PROJECTPOINTS	AVERAGE POINTS	ACTUAL DATA	ACTUAL POINTS	EVALUATION
SOCIAL									
SMART SERVICES									
S-R 1	EDUCATIO N	S-R 1-2	Percentage of students completing primary education	-	-	0,3	-	-	
		S-R 1-4	number of education structures in a specific area	-	-	0,3	-	-	
S-R 2	HEALTH	S-R 2-1	Mortality	-	-	0,18	-	-	
		S-R 2-3	Average life expectancy	-	-	0,18	-	-	
		S-R 2-6	Mortality of major disease	-	-	0,24	-	-	
S-R 3	SAFETY	S-R 3-1	Homicide rate	-	-	0,24	-	-	
		S-R 3-3	Crime rate	-	-	0,24	-	-	
S-R 4	FIRE &	S-R 4-1	Firefighting rate	-	-	0,24	-	-	
S-R 5	TRANSPO RTATION	S-R 5-1	High capacity public transit	-	-	0,27	-	-	
		S-R 5-2	Light passenger transit system	-	-	0,27	-	-	
		S-R 5-6	Mode of transportation used by children to travel between home and school	-	-	0,27	-	-	
		S-R 5-8	Reduced Mobility	-	-	0,27	-	-	
S-R 6	HOUSING	S-R 6-1	Total number of households	-	-	0,18	-	-	
		S-R 6-3	Persons per unit	-	-	0,18	-	-	
		S-R 6-8	Slums	-	-	0,18	-	-	
		S-R 6-11	Poor households	-	-	0,18	-	-	
		S-R 6-12	Secure tenure	-	-	0,18	-	-	

CATEGORY		INDICATOR		PROJECT DATA	PROJECTPOINTS	AVERAGE POINTS	ACTUAL DATA	ACTUAL POINTS	EVALUATION
S-R 7	CULTURE	S-R 7-1	Structures	-	-	0,42	-	-	
S-R 8	RECREATION	S-R 8-1	Indoor recreation facilities	-	-	0,36	-	-	
		S-R 8-2	Outdoor recreation facilities	-	-	0,36	-	-	
S-R 9	NATURAL HAZARDS	S-R 9-2	Human and economic loss due to natural disasters	-	-	0,42	-	-	
S-R 10	INNOVATION	S-R 10-1	University	-	-	0,72	-	-	
SOCIAL EQUITY									
S-E 1	POPULATION	S-E 1 4	Senior citezens	-	-	0,6	-	-	
		S-E 1 6	Annual population change	-	-	0,6	-	-	
		S-E 1 8	Immigrants	-	-	0,42	-	-	
		S-E 1 10	Integration	-	-	0,42	-	-	
S-E 2	POVERTY	S-E 2-1	Population in poverty	-	-	0,48	-	-	

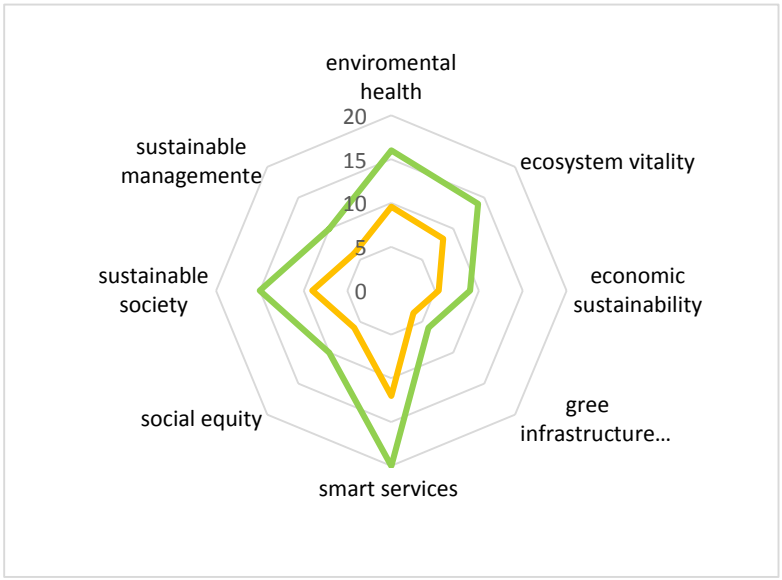
CATEGORY		INDICATOR		PROJECT DATA	PROJECTPOINTS	AVERAGE POINTS	ACTUAL DATA	ACTUAL POINTS	EVALUATION
ECONOMY									
ECONOMIC DEVELOPMENT									
S-S 1	ECONOMIC DEVELOP	S-S 1-1	Cost of living	-	-	0,48	-	-	
		S-S 1-2	Total employment	-	-	0,48	-	-	
		S-S 1-10	Inflation Rate	-	-	0,48	-	-	
S-S 2	FINANCE	S-S 2-1	Debt service ratio	-	-	0,48	-	-	
		S-S 2-5	Private investiment in public sustaintability projects	-	-	0,75	-	-	
		S-S 2-6	Public investiment in public sustaintability projects	-	-	0,75	-	-	
S-S 3	RESOURCES	S-S 3-1	Price of water	-	-	0,6	-	-	
		S-S 3-2	Price of energy	-	-	0,6	-	-	
		S-S 3-5	Price of materials	-	-	0,6	-	-	

CATEGORY		INDICATOR		PROJECT DATA	PROJECTPOINTS	AVERAGE POINTS	ACTUAL DATA	ACTUAL POINTS	EVALUATION
GOVERNANCE									
SUSTAINABLE MANAGEMENT									
S-M 1	GOVERNMENT	S-M 1-1	Type of government (e.g. Local, Regional, County)	-	-	0,66	-	-	
		S-M 1-2	Gross operating budget	-	-	0,66	-	-	
		S-M 1-4	Women in the goverment	-	-	0,66	-	-	
S-M 3	EFFICENCY	S-M 3-1	Corruption	-	-	0,72	-	-	
		S-M 3-3	Competitive Index	-	-	0,72	-	-	
		S-M 3-4	Enviromental and social management	-	-	0,72	-	-	

SYSTEM of SUSTAINABLE URBAN PLANNING

MONITORING CERTIFICATION

INDICATORS	EVALUATION SCORE	MONITORING SCORE
ENVIRONMENTAL		
Enviromental Health		
Ecosystem Vitality		
Economic Sustainability		
Gree Infrastructure and Buildings		
SOCIAL		
Smart Services		
Social Equity		
ECONOMY		
Sustainable Society		
GOVERNANCE		
Sustainable Managemente		
TOTAL		



CERTIFICATION

Average Points

Avaiable Points